US Army Corps
of Engineers

The Hydrologic
Engineering Center

AD-A235 608

GENERALIZED COMPUTER PROGRAM

Regional Frequency Computation

Users Manual

July 1972

10 December 1984

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REGIONAL FREQUENCY COMPUTATION

HYDROLOGIC ENGINEERING CENTER
COMPUTER PROGRAM 723-X6-L7350

JULY 1972

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
650 CAPITOL MALL
SACRAMENTO, CALIFORNIA

6/82

REGIONAL FREQUENCY COMPUTATION

HYDROLOGIC ENGINEERING CENTER
COMPUTER PROGRAM 723-X6-L7350

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REGIONAL FREQUENCY COMPUTATION

HYDROLOGIC ENGINEERING CENTER
723-X6-L7350

1. INTRODUCTION

This program was prepared in the Hydrologic Engineering Center. Up-to-date information and copies of source statement cards for various types of computers can be obtained from the Center upon request by Government and cooperating agencies. While every care is taken to validate this program, it is not feasible to anticipate and test all possible applications. Consequently, the Center is interested in problems that arise in application and will assist in resolving deficiencies in the program to the extent feasible.

2. PURPOSE OF PROGRAM

The purpose of this program is to perform frequency computations of annual maximum hydrologic events necessary to a regional frequency study. Frequency statistics are computed for recorded events at each station and for each duration. Missing events are computed so that complete sets of events are obtained for all years at all stations while preserving all inter-correlations. These are arranged in the order of magnitude for each station and duration and tabulated with median plotting positions. Statistics for each station are then adjusted to the complete period of region record, and frequency curves are computed in accordance with procedures given in "Statistical Methods in Hydrology" by Leo R. Beard, January 1962, using the logarithmic Pearson Type III function and the expected-probability concept. The use of all long-record stations instead of only one for the extension of frequency statistics at short-record stations is considered to constitute some advantage over procedures given in "Statistical Methods". As an alternative use of this program, frequency statistics can be supplied and curves will be computed.

3. DESCRIPTION OF EQUIPMENT

A FORTRAN IV compiler, random number generator (function RNGEN included, see Exhibit 2), and large memory are required. The large amounts of computation make high speed desirable. Accordingly, it is virtually necessary to use a computer of the IBM 7094 class for execution of this program. It is desirable to use one input tape and one output tape unit, in addition to card (tape 7) and printer (tape 6) output and standard (tape 5) input.

4. METHODS OF COMPUTATION

a. Flows for those stations with zeros in the data are first incremented by 1/10 percent of their average for each station and duration in order to preclude infinite negative logarithms. This increment, if added, is later subtracted from reconstituted flows and computed frequency curves. The mean, standard deviation and skew coefficient of the logarithms for each station and duration are then computed. Preliminary to estimating missing flows by correlation, each flow is then converted to a standardized variate using an approximation of the Pearson Type III distribution. This involves the following equations:

$$X_{i,m} = \log (Q_{i,m}+q_i) \tag{1}$$

$$\bar{X}_i = \sum_{m=1}^{N} X_{i,m}/N \tag{2}$$

$$S_i = \sqrt{\sum_{m=1}^{N} (X_{i,m}-\bar{X}_i)^2/(N-1)} \tag{3}$$

$$g_i = N \sum_{m=1}^{N} (X_{i,m}-\bar{X}_i)^3/((N-1)(N-2)S_i^3) \tag{4}$$

$$t_{i,m} = (X_{i,m}-\bar{X}_i)/S_i \tag{5}$$

$$K_{i,m} = 6/g_i \left[((g_i t_{i,m}/2) +1)^{1/3} - 1\right] + g_i/6 \tag{6}$$

in which:

X = Logarithm of flow event
Q = Recorded flow event
q = Small increment of flow used to prevent infinite logarithms for events with zero flow
$\bar{X}$ = Mean logarithm of flow events
N = Total years of record
S = Unbiased estimate of population standard deviation
g = Unbiased estimate of population skew coefficient
t = Pearson Type III standard deviate
i = Duration number
m = Year number
K = Normal standard deviate

b. After transforming the flows for all stations and durations to normal, the gross (simple) correlation coefficients R between all pairs of stations for each duration and for adjacent durations at each station are computed by use of the following formula:

$$R_i = \left\{ 1 - \left[1 - \left(\sum_{m=1}^{N} (x_{i,m} x_{i-1,m} \right)^2 / \left(\sum_{m=1}^{N} x^2_{i,m} \sum_{m=1}^{N} x^2_{i-1,m} \right) \right] \right.$$

$$\left. (N-1)/(N-2) \right\}^{\frac{1}{2}} \qquad (7)$$

c. Inasmuch as not all stations and durations necessarily have the same length of record, correlation matrices obtained in b might not be complete or internally consistent. If not, missing values are estimated, and low values are raised to obtain consistency, inasmuch as low values are least reliable and least influential. Each missing value is estimated by examining its relationship to related pairs of values by use of the following formula, using i, j and k subscripts to indicate variables used in the gross correlation:

$$R_{ij} = R_{ki} R_{kj} \pm \sqrt{(1-R_{ki}^2)(1-R_{kj}^2)} \qquad (8)$$

d. Consistency of each correlation matrix to be used for estimating missing flows is assured by first testing all combinations of triads of correlation coefficients used in that matrix. The test for consistency of each complete matrix is made by computing the multiple correlation coefficient. If this value is greater than 1.0, further adjustment is required. Such further adjustment is obtained by introducing a coefficient, successively smaller by .2, on the radical in equation 8 and repeating all triad consistency tests until all matrices are consistent.

e. Missing flows are estimated by correlation with corresponding flows at other stations and the flow at the same station for the adjacent duration (preceding duration, except that the succeeding duration is used when estimating for the first tabulated duration). Since it is not known which stations might have recorded or previously estimated values, the correlation matrix and regression equation might be different for the same station and duration in different years. The regression equation is computed for each missing value in terms of normal standard variates by selecting required coefficients from the complete (and consistent) correlation matrix and solving by the Crout method explained in Exhibit 1. The missing value is computed from this regression equation,

introducing a random component equal to the non-determination of the equation, in order to preserve the proper variance (standard deviation) of the flows. This is done as follows:

$$k_1 = \beta_2 k_2 + \beta_3 k_3 + \ldots . \beta_n k_n + \sqrt{1-R^2}\ Z \qquad (9)$$

in which:

k = Normal standard deviate
β_2 = Beta coefficient
R^2 = Determination coefficient
Z = Random number normally distributed
n = Number of variables in equation

f. When all flows have been reconstituted, the mean and standard deviation for each station and duration are recomputed. Regression lines of standard deviation and skew coefficient separately versus mean are computed, and "smoothed" values of standard deviation and skew obtained as described in "Statistical Methods". Equivalent record for the recorded and reconstituted flows for each station and duration is estimated by adding the determination coefficient for each year of reconstituted flow to the total years of recorded flows. This equivalent record is used in computing expected probabilities as discussed below. Flows are arranged in descending order of magnitude and median plotting positions are computed as defined in "Statistical Methods". Frequency-curve coordinates for each station and duration are computed from the mean, standard deviation, skew coefficient, flow increment and equivalent record length, using table values of the normal distribution, the transform for the Pearson Type III function shown in Equation 10, and the following approximate transforms for expected probability:

$$P_{.01} = .01\ (1+1600/N^{1.72}) \qquad (10)$$

$$P_{.1} = .1\ (1+280/N^{1.55}) \qquad (11)$$

$$P_{1} = 1 + 26/N^{1.16} \qquad (12)$$

$$P_5 = 5\ (1 + 6/N^{1.04}) \quad (13)$$

$$P_{10} = 10\ (1 + 3/N^{1.04}) \quad (14)$$

$$P_{30} = 30\ (1 + .46/N^{.925}) \quad (15)$$

in which:

P = Expected probability in percent, symmetrical about 50 percent
N = Equivalent years of record

5. INPUT

Input is summarized in Exhibits 6 and 7. All data are entered consecutively on each card, using 8 columns (digits, including decimal point, if used) per variable and 10 variables per card unless fewer variables are called for, except that the first column on each card is reserved for identification. The first output title card must have an A in column 1. An example of input is given in Exhibit 2. Certain inadequacies of data will abort the job and waste input cards until the next card with A in column 1 is reached. After a job is finished, a card with A in column 1 followed by 3 blank cards causes the computer to stop.

6. OUTPUT

Printed output includes key input information for job identification and all results of computations. An example of printed output is given in Exhibit 3.

7. OPERATING INSTRUCTIONS

Standard FORTRAN IV instructions and random number generator are required. No sense switches are used.

8. DEFINITIONS OF TERMS

Terms used in the program are defined in Exhibit 4.

9. PROPOSED FUTURE DEVELOPMENT

No specific future development of this program is presently planned. It is requested that any user who finds an inadequacy or desirable addition or modification notify the Hydrologic Engineering Center.

July 1972

EXHIBIT 1

Crout's Method

One of the best methods for solving systems of linear equations on desk calculating machines was developed by P. D. Crout in 1941. This method is based on the elimination method, with the calculations arranged in systematic order so as to facilitate their accomplishment on a desk calculator. In this method the coefficients and constant terms of the equations are written in the form of a "matrix," which is a rectangular array of quantities arranged in rows and columns.

The method is best explained by an example. Suppose that in a multiple correlation analysis it is required to solve the following system of linear equations to obtain the unknown values of b_2, b_3, b_4 and b_5.

$$\Sigma x_2^2\ b_2 + \Sigma x_2x_3\ b_3 + \Sigma x_2x_4\ b_4 + \Sigma x_2x_5\ b_5 = \Sigma x_1x_2$$

$$\Sigma x_2x_3\ b_2 + \Sigma x_3^2\ b_3 + \Sigma x_3x_4\ b_4 + \Sigma x_3x_5\ b_5 = \Sigma x_1x_3$$

$$\Sigma x_2x_4\ b_2 + \Sigma x_3x_4\ b_3 + \Sigma x_4^2\ b_4 + \Sigma x_4x_5\ b_5 = \Sigma x_1x_4$$

$$\Sigma x_2x_5\ b_2 + \Sigma x_3x_5\ b_3 + \Sigma x_4x_5\ b_4 + \Sigma x_5^2\ b_5 = \Sigma x_1x_5$$

For simplicity let us replace the coefficients of the b's by the letters p, q, r and s, and the constant terms by the letter t, using subscripts 1, 2, 3 and 4 to denote the respective equations:

$$p_1\ b_2 + q_1\ b_3 + r_1\ b_4 + s_1\ b_5 = t_1$$

$$p_2\ b_2 + q_2\ b_3 + r_2\ b_4 + s_2\ b_5 = t_2$$

$$p_3\ b_2 + q_3\ b_3 + r_3\ b_4 + s_3\ b_5 = t_3$$

$$p_4\ b_2 + q_4\ b_3 + r_4\ b_4 + s_4\ b_5 = t_4$$

A continuous check on the computations as they progress may be obtained by adding to the matrix of the above system a column of u's, such that $u = p + q + r + s + t$. The matrix and check column are written as follows:

$$\begin{vmatrix} p_1 & q_1 & r_1 & s_1 & t_1 & u_1 \\ p_2 & q_2 & r_2 & s_2 & t_2 & u_2 \\ p_3 & q_3 & r_3 & s_3 & t_3 & u_3 \\ p_4 & q_4 & r_4 & s_4 & t_4 & u_4 \end{vmatrix}$$

The elements p_1, q_2, r_3 and s_4 form the "principal diagonal" of the matrix. Examination of the original equations shows that the coefficients are symmetrical about the principal diagonal, i.e., $q_1 = p_2$, $r_1 = p_3$, $r_2 = q_3$, $s_1 = p_4$, $s_2 = q_4$, and $s_3 = r_4$. This is characteristic of the system of equations to be solved in any multiple correlation analysis. Because of this symmetry, the computations are considerably simplified. While the Crout method may be used to solve any system of linear equations, the computational steps given here are applicable only to those with symmetrical coefficients.

The solution consists of two parts, viz., the computation of a "derived matrix" and the "back solution." Let the derived matrix be denoted as follows:

$$\begin{vmatrix} P_1 & Q_1 & R_1 & S_1 & T_1 & U_1 \\ P_2 & Q_2 & R_2 & S_2 & T_2 & U_2 \\ P_3 & Q_3 & R_3 & S_3 & T_3 & U_3 \\ P_4 & Q_4 & R_4 & S_4 & T_4 & U_4 \end{vmatrix}$$

The elements of the derived matrix are computed as follows:

$$P_1 = p_1 \qquad P_2 = p_2 \qquad P_3 = p_3 \qquad P_4 = p_4$$

$$Q_1 = \frac{q_1}{p_1} \qquad R_1 = \frac{r_1}{p_1} \qquad S_1 = \frac{s_1}{p_1} \qquad T_1 = \frac{t_1}{p_1} \qquad U_1 = \frac{u_1}{p_1}$$

$$Q_2 = q_2 - P_2Q_1 \qquad Q_3 = q_3 - P_3Q_1 \qquad R_2 = \frac{Q_3}{Q_2}$$

$$Q_4 = q_4 - P_4Q_1 \qquad S_2 = \frac{Q_4}{Q_2} \qquad T_2 = \frac{t_2 - T_1P_2}{Q_2} \qquad U_2 = \frac{u_2 - U_1P_2}{Q_2}$$

$$R_3 = r_3 - Q_3R_2 - P_3R_1 \qquad R_4 = r_4 - Q_4R_2 - P_4R_1 \qquad S_3 = \frac{R_4}{R_3}$$

$$T_3 = \frac{t_3 - T_2Q_3 - T_1P_3}{R_3} \qquad U_3 = \frac{u_3 - U_2Q_3 - U_1P_3}{R_3}$$

$$S_4 = s_4 - R_4S_3 - Q_4S_2 - P_4S_1$$

$$T_4 = \frac{t_4 - T_3R_4 - T_2Q_4 - T_1P_4}{S_4} \qquad U_4 = \frac{u_4 - U_3R_4 - U_2Q_4 - U_1P_4}{S_4}$$

The general pattern of the above computations, which may be applied to a system containing any number of equations, is as follows:

(1) The first column of the derived matrix is copied from the first column of the given matrix.

(2) The remaining elements in the first row of the derived matrix are computed by dividing the corresponding elements in the first row of the given matrix by the first element in that row.

(3) After completing the n^{th} row, the remaining elements in the $(n+1)^{th}$ column are computed. Such an element (X) equals the corresponding element of the given matrix minus the product of the element immediately to the left of (X) by the element immediately above the principal diagonal in the same column as (X), minus the product of the second element to the left of (X) by the second element above the principal diagonal in the same column as (X), etc. After each element below the principal diagonal is recorded, and while that element is still in the calculator, it is divided by the element of the principal diagonal which is in the same column. The quotient is the element whose location is symmetrical to (X) with respect to the principal diagonal.

EXHIBIT 1

(4) When the elements in the $(n+1)^{\underline{th}}$ column and their symmetrical counterparts have been recorded, the $(n+1)^{\underline{th}}$ row will be complete except for the last two elements, which are next computed. Such an element (X) equals the corresponding element of the given matrix minus the product of the element immediately above (X) by the element immediately to the left of the principal diagonal in the same row as (X), minus the product of the second element above (X) by the second element to the left of the principal diagonal in the same row as (X), etc., all divided by the element of the principal diagonal in the same row as (X).

The check column (U) of the derived matrix serves as a continuous check on the computations in that each element in the column equals one plus the sum of the elements in the same row to the right of the principal diagonal. That is,

$$U_1 = 1 + Q_1 + R_1 + S_1 + T_1$$

$$U_2 = 1 + R_2 + S_2 + T_2$$

$$U_3 = 1 + S_3 + T_3$$

$$U_4 = 1 + T_4$$

This check should be made after completing each row.

The elements of the derived matrix to the right of the principal diagonal form a system of equations which may now be used to compute the unknown values of b_2, b_3, b_4 and b_5 by successive substitution. This is known as the "back solution." The computations are as follows:

$$b_5 = T_4$$

$$b_4 = T_3 - S_3 b_5$$

$$b_3 = T_2 - S_2 b_5 - R_2 b_4$$

$$b_2 = T_1 - S_1 b_5 - R_1 b_4 - Q_1 b_3$$

It is very important that the computations be carried to a sufficient number of digits, both in computing the coefficients and constant terms of the original equations, and in computing the elements of the derived matrix. It is possible for relatively small errors in the coefficients and constant terms of the original equations to result in relatively large errors in the computed solutions of the unknowns. The

greatest source of error in computing the elements of the derived matrix arises from the loss of leading significant digits by subtraction. This must be guarded against and can be done by carrying the computations to more figures than the data. As a general rule, it is recommended that the coefficients and constant terms of the original equations be carried to a sufficient number of decimals to produce at least five significant digits in the smallest quantity, and that the elements of the derived matrix be carried to one more decimal than this, but to not less than six significant digits.

EXHIBIT 1

EXHIBIT 2

RANDOM NUMBER FUNCTION RNGEN

This random number function is for a binary machine and the constants must be computed according to the number of bits in an integer word. The numbers generated are uniformly distributed in the interval 0 to 1.

The function is called from the main program by a statement similar to the following:

A = RNGEN (IX)

Where A is some floating point variable name and IX is some integer variable name. The argument name IX need not be the same in the main program and the function. The argument must be initialized to zero in the main program. The location of the initializing statement is important and depends on the results desired. If it is desired to have different sets of random numbers for each of several different sets of computations (jobs) that are run sequentially on the same program, then the argument must be initialized at the very beginning of the program and never reinitialized. If it is permissible to use the same sequence of random numbers for each job, the argument must be initialized at the beginning of each job. The advantage of this latter option occurs when one of the jobs must be re-run for some minor reason as the same random numbers will be used and the results will be comparable.

Three constants must be computed by the following equations:

Constant one (C1) = $2^{(B+1)/2} + 3$

Constant two (C2) = $2^{B} - 1$

Constant three (C3) = $1./2.^{B}$

Where: B = number of bits in an integer word

The constants for some of the common computers are listed in the following table:

COMPUTER	SIZE OF INTEGER WORD	CONSTANTS C1	C2	C3
GE 200 Series	19	1027	524287	0.190734863E-05
GE 400 Series	23	4099	8388607	0.119209290E-06
IBM 360 Series	31	65539	2147483647	0.465661287E-09
IBM 7040 and 7090 Series	35	262147	34359738367	0.29103830 46E-10
UNIVAC 1108				
CDC 6000 Series	48	16777219	281474976710655	0.355271367 8E-14

EXHIBIT 2

```
A                          REGIONAL FREQUENCY COMPUTATION
A                                  TEST DATA
A                                  JULY 1972
B      1     1945       1
C   PEAK
D     0.
G     32     1945   77100
G     32     1946  206000
G     32     1948  185000
G     32     1949  137000
G     32     1950   99000
H
A                                  TEST DATA
A                                723-X6-L7350
A                          MULTIPLE STATION AND DURATION
B      5     1945
C   PEAK   1-DAY   3-DAY  10-DAY  30-DAY
G     32     1945   77100   71200   62000   51000   30830
G     32     1946  206000  185000  134000   83400   51000
G     32     1947  138000  132000  115000   65300   43670
G     32     1948  185000  167000  132000   85600   44130
G     32     1949  137000  122000   70400   66800   38130
G     32     1950   99000   95900   90000   64200   46100
G     35     1946   48400   32500   24300   12870    7493
G     35     1947   46000   32600   29270   16020    9570
G     35     1948   53400   40300   24870   12980    6890
G     35     1949   18600   14600   10570    8090    5690
G     35     1950   23600   20100   15800    9840    6920
H
A                                  TEST DATA
A                                723-X6-L7350
A                          SAVE STATIONS FROM PREVIOUS JOB
B      5     1945       1       2
C   PEAK   1-DAY   3-DAY  10-DAY  30-DAY
D    -.2    -.4    -.5    -.6    -.8
E     32     35
G     33     1945    5530    5040    4100    3320    2270
G     33     1946   13300    9560    7700    4840    3150
G     33     1947   10300    9360    8530    4850    3540
G     33     1948   10300    8840    6930    4230    2790
G     33     1949    6470    5400    4300    3120    2330
H
A                                  TEST DATA
A                                723-X6-L7350
A                          STATISTICS FURNISHED
B      5     1945       1                                    2      -1
C   PEAK   1-DAY   3-DAY  10-DAY  30-DAY
D    -.2    -.4    -.5    -.6    -.8
I     32    PEAK  5.123   .159  -.334     0.     6.0
I     32   1-DAY  5.089   .153  -.366     0.     6.0
I     32   3-DAY  4.984   .133  -.462     0.     6.0
I     32  10-DAY  4.835   .106  -.599     0.     6.0
I     32  30-DAY  4.621   .066  -.795     0.     6.0
I     35    PEAK  4.518   .196  -.278     0.     5.6
I     35   1-DAY  4.408   .177  -.168     0.     6.0
I     35   3-DAY  4.267   .153  -.027     0.     6.0
I     35  10-DAY  4.052   .117   .188     0.     5.8
I     35  30-DAY  3.843   .082   .398     0.     5.9
A
A
A
```

EXAMPLE OUTPUT

```
**********************************
JULY 1972          723-X6-L2350
REGIONAL FREQUENCY COMPUTATION
VERSION DATE - AUGUST 21, 1979
**********************************
```

REGIONAL FREQUENCY COMPUTATION
TEST DATA
JULY 1972

NDUR	IYRA	ISKEW	KEEP	ICONV	IPCHQ	IPCHS	NSTAT	NSMTH	INCAD
1	1945	1	-0	-0	-0	-0	-0	-0	-0

REGIONAL SKEW COEFFICIENTS

PEAK
0.

FREQUENCY STATISTICS OF RECORDED DATA

STA	ITEM	PEAK
32	MEAN	5.120
	STD DEV	.100
	SKEW	-.296
	INCRMT	0.
	YEARS	5.

RECORDED AND RECONSTITUTED DATA

STA	YEAR	PEAK
32	1945	77100.
32	1946	206000.
32	1948	165000.
32	1949	137000.
32	1950	99000.

FREQUENCY ARRAYS

STATION 32

NO	PLOT	PEAK
1	12.99	206000.
2	31.17	165000.
3	50.00	137000.
4	68.83	99000.
5	87.06	77100.

ADOPTED FREQUENCY STATISTICS

STA	ITEM	PEAK
32	MEAN	5.120
	STD DEV	.180
	SKEW	0.
	INCRMT	0.

COMPUTED FREQUENCY CURVES

STATION 32

PLOT	EXP PROB	PEAK
.01	1.01	617437.
.10	2.41	473747.
1.00	5.02	345883.
5.00	10.63	259953.
10.00	15.63	223966.
30.00	33.11	163518.
50.00	50.00	131853.
70.00	66.89	106320.
90.00	84.37	77624.
95.00	89.37	66878.
99.00	94.98	50263.
99.90	97.59	36697.
99.99	98.99	28157.

****
JULY 1972 723-X6-L2350
REGIONAL FREQUENCY COMPUTATION
VERSION DATE - AUGUST 21, 1979
****

TEST DATA
723-X6-L2350
MULTIPLE STATION AND DURATION

NDUR	IYRA	ISKEW	KEEP	ICONV	IPCHQ	IPCHS	NSTAT	NSMTH	INCAD
5	1945	-0	-0	-0	-0	-0	-0	-0	-0

FREQUENCY STATISTICS OF RECORDED DATA

STA	ITEM	PEAK	1-DAY	3-DAY	10-DAY	30-DAY
32	MEAN	5.123	5.089	4.984	4.835	4.621
	STD DEV	.161	.154	.142	.083	.076
	SKEW	-.388	-.527	-.375	-.266	-1.088
	INCRMT	0.	0.	0.	0.	0.
	YEARS	6.	6.	6.	6.	6.
35	MEAN	4.544	4.420	4.294	4.066	3.858
	STD DEV	.208	.181	.181	.116	.082
	SKEW	-.689	-.721	-.964	-.384	.593
	INCRMT	0.	0.	0.	0.	0.
	YEARS	5.	5.	5.	5.	5.

FREQUENCY STATISTICS AFTER ADJUSTMENT WITH A LONG TERM STATION

STA	ITEM	PEAK	1-DAY	3-DAY	10-DAY	30-DAY
32	MEAN	5.123	5.089	4.984	4.835	4.621
	STD DEV	.161	.154	.142	.083	.076
	SKEW	-.334	-.366	-.462	-.599	-.795
	INCRMT	0.	0.	0.	0.	0.
	EQUIV YRS	6.0	6.0	6.0	6.0	6.0
35	MEAN	4.498	4.376	4.242	4.033	3.838
	STD DEV	.227	.202	.208	.133	.091
	SKEW	-.734	-.612	-.478	-.269	-.073
	INCRMT	0.	0.	0.	0.	0.
	EQUIV YRS	5.3	5.3	5.8	5.0	5.0

EXHIBIT 4

CORRELATION COEFFICIENTS OF RECORDED DATA FOR PEAK DURATION

STA	32	35
	WITH SAME DURATION	
32	1.000	.616
35	.616	1.000
	WITH ADJACENT DURATION AT ABOVE STATION	
32	.995	.494
35	.714	.982

CORRELATION COEFFICIENTS OF RECORDED DATA FOR 1-DAY DURATION

STA	32	35
	WITH SAME DURATION	
32	1.000	.604
35	.604	1.000
	WITH ADJACENT DURATION AT ABOVE STATION	
32	.995	.714
35	.494	.962

CORRELATION COEFFICIENTS OF RECORDED DATA FOR 3-DAY DURATION

STA	32	35
	WITH SAME DURATION	
32	1.000	.867
35	.867	1.000
	WITH ADJACENT DURATION AT ABOVE STATION	
32	.848	.949
35	.330	.898

CORRELATION COEFFICIENTS OF RECORDED DATA FOR 10-DAY DURATION

STA	32	35
	WITH SAME DURATION	
32	1.000	0.
35	0.	1.000
	WITH ADJACENT DURATION AT ABOVE STATION	
32	.827	0.
35	.753	.981

CORRELATION COEFFICIENTS OF RECORDED DATA FOR 30-DAY DURATION

STA	32	35
	WITH SAME DURATION	
32	1.000	0.
35	0.	1.000
	WITH ADJACENT DURATION AT ABOVE STATION	
32	.690	0.
35	0.	.893

RECORDED AND RECONSTITUTED DATA

STA	YEAR	PEAK	1-DAY	3-DAY	10-DAY	30-DAY
32	1945	77100.	71200.	62000.	51000.	30830.
32	1946	204000.	185000.	134000.	83400.	51000.
32	1947	138000.	133000.	115000.	65300.	43670.
32	1948	165000.	167000.	132000.	85600.	44130.
32	1949	137000.	122000.	70400.	66800.	38130.
32	1950	99000.	95900.	90000.	64200.	46100.

STA	YEAR	PEAK	1-DAY	3-DAY	10-DAY	30-DAY
35	1945	25357.E	20407.E	20362.E	12398.E	8837.E
35	1946	48400.	32500.	24300.	12870.	7493.
35	1947	46000.	32400.	29270.	16020.	9570.
35	1948	53400.	40300.	24870.	12980.	6890.
35	1949	18600.	14600.	10570.	8090.	5690.
35	1950	23600.	20100.	15800.	9840.	6920.

EXHIBIT 4

FREQUENCY STATISTICS OF RECORDED AND RECONSTITUTED DATA

STA	ITEM	PEAK	1-DAY	3-DAY	10-DAY	30-DAY
32	MEAN	5.123	5.089	4.984	4.835	4.621
	STD DEV	.161	.154	.142	.083	.076
	SKEW	-.388	-.527	-.375	-.266	-1.088
	EQUIV YRS	6.0	6.0	6.0	6.0	6.0
35	MEAN	4.520	4.401	4.297	4.070	3.873
	STD DEV	.194	.168	.162	.104	.082
	SKEW	-.176	-.240	-1.036	.573	-.012
	EQUIV YRS	5.4	6.0	5.8	6.0	5.8

CORRELATION COEFFICIENTS OF RECORDED AND RECONSTITUTED DATA FOR PEAK DURATION

STA	32	35
	WITH SAME DURATION	
32	1.000	.574
35	.574	1.000
	WITH ADJACENT DURATION AT ABOVE STATION	
32	.995	.475
35	.616	.986

CORRELATION COEFFICIENTS OF RECORDED AND RECONSTITUTED DATA FOR 1-DAY DURATION

STA	32	35
	WITH SAME DURATION	
32	1.000	.526
35	.526	1.000
	WITH ADJACENT DURATION AT ABOVE STATION	
32	.995	.616
35	.475	.986

CORRELATION COEFFICIENTS OF RECORDED AND RECONSTITUTED DATA FOR 3-DAY DURATION

STA	32	35
	WITH SAME DURATION	
32	1.000	.558
35	.558	1.000
	WITH ADJACENT DURATION AT ABOVE STATION	
32	.836	.848
35	0.	.375

CORRELATION COEFFICIENTS OF RECORDED AND RECONSTITUTED DATA FOR 10-DAY DURATION

STA	32	35
	WITH SAME DURATION	
32	1.000	0.
35	0.	1.000
	WITH ADJACENT DURATION AT ABOVE STATION	
32	.820	0.
35	.385	.977

CORRELATION COEFFICIENTS OF RECORDED AND RECONSTITUTED DATA FOR 30-DAY DURATION

STA	32	35
	WITH SAME DURATION	
32	1.000	0.
35	0.	1.000
	WITH ADJACENT DURATION AT ABOVE STATION	
32	.744	0.
35	0.	.819

FREQUENCY ARRAYS

STATION 32

NO	PLOT	PEAK	1-DAY	3-DAY	10-DAY	30-DAY
1	10.91	206000.	185000.	134000.	85600.	51000.
2	26.55	185000.	167000.	122000.	83400.	46100.
3	42.18	138000.	133000.	115000.	66800.	44130.
4	57.82	137000.	122000.	90000.	65300.	43670.
5	73.45	99000.	95900.	70400.	64200.	38130.
6	89.09	77100.	71200.	62000.	51000.	30830.

STATION 35

NO	PLOT	PEAK	1-DAY	3-DAY	10-DAY	30-DAY
1	10.91	53400.	40300.	29270.	16020.	9570.
2	26.55	48400.	32600.	24870.	12980.	8837.E
3	42.18	46000.	32500.	24300.	12870.	7493.
4	57.82	25357.E	20407.E	20362.E	12398.E	6920.
5	73.45	23600.	20100.	15800.	9840.	6890.
6	89.09	18600.	14600.	10570.	8090.	5690.

ADOPTED FREQUENCY STATISTICS

STA	ITEM	PEAK	1-DAY	3-DAY	10-DAY	30-DAY
32	MEAN	5.123	5.089	4.984	4.835	4.621
	STD DEV	.159	.153	.133	.106	.066
	SKEW	-.334	-.366	-.462	-.599	-.795
	INCRMT	0.	0.	0.	0.	0.
35	MEAN	4.520	4.401	4.297	4.070	3.873
	STD DEV	.193	.172	.153	.113	.078
	SKEW	-.462	-.437	-.414	-.365	-.322
	INCRMT	0.	0.	0.	0.	0.

COMPUTED FREQUENCY CURVES

STATION 32

PLOT	EXP PROB	PEAK	1-DAY	3-DAY	10-DAY	30-DAY
.01	.74	404931.	350275.	227309.	127137.	58610.
.10	1.84	347604.	304541.	204648.	119050.	57022.
1.00	4.25	284819.	253204.	177239.	108179.	54512.
5.00	9.65	233536.	210253.	152569.	97369.	51625.
10.00	14.65	209104.	189451.	140041.	91478.	49894.
30.00	32.63	162936.	149301.	114730.	78748.	45770.
50.00	50.00	135505.	125410.	98620.	70015.	42627.
70.00	67.37	111592.	103994.	83702.	61444.	39276.
90.00	85.35	82252.	77412.	64306.	49526.	34128.
95.00	90.35	70568.	66693.	56175.	44236.	31637.
99.00	95.75	51767.	49272.	42524.	34903.	26879.
99.90	98.16	35879.	34363.	30350.	26017.	21825.
99.99	99.26	25794.	24800.	22260.	19751.	17860.

STATION 35

PLOT	EXP PROB	PEAK	1-DAY	3-DAY	10-DAY	30-DAY
.01	.79	115212.	77843.	54915.	25533.	12892.
.10	1.94	98922.	67581.	48195.	23022.	11952.
1.00	4.40	80287.	55798.	40443.	20083.	10832.
5.00	9.84	64601.	45790.	33798.	17503.	9824.
10.00	14.84	57035.	40914.	30330.	16205.	9305.
30.00	32.72	42704.	31545.	24167.	13601.	8235.
50.00	50.00	34293.	25926.	20280.	11944.	7529.
70.00	67.28	27020.	20980.	16797.	10399.	6847.
90.00	85.16	18429.	14956.	12443.	8360.	5903.
95.00	90.16	15146.	12582.	10681.	7488.	5480.
99.00	95.60	10111.	8824.	7816.	5986.	4716.
99.90	98.06	6197.	5753.	5372.	4586.	3950.
99.99	99.21	3951.	3889.	3815.	3604.	3369.

EXHIBIT 4

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**********
JULY 1972          723-X6-L2350
REGIONAL FREQUENCY COMPUTATION
VERSION DATE - AUGUST 21, 1979
**********
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TEST DATA
723-X6-L2350
SAVE STATIONS FROM PREVIOUS JOB

NDUR	IYRA	ISKEW	KEEP	ICONV	IPCHQ	IPCHS	NSTAT	NSMTH	INCAO
5	1945	1	2	-0	-0	-0	-0	-0	-0

REGIONAL SKEW COEFFICIENTS

PEAK	1-DAY	3-DAY	10-DAY	30-DAY
-.200	-.400	-.500	-.600	-.800

STATION(S) KEPT FROM LAST RUN, 32, 35,

FREQUENCY STATISTICS OF RECORDED DATA

STA	ITEM	PEAK	1-DAY	3-DAY	10-DAY	30-DAY
33	MEAN	3.941	3.867	3.781	3.602	3.443
	STD DEV	.158	.137	.148	.090	.083
	SKEW	-.320	-.599	-.412	-.371	.180
	INCRMT	0.	0.	0.	0.	0.
	YEARS	5.	5.	5.	5.	5.

FREQUENCY STATISTICS AFTER ADJUSTMENT WITH A LONG TERM STATION

STA	ITEM	PEAK	1-DAY	3-DAY	10-DAY	30-DAY
32	MEAN	5.123	5.089	4.984	4.835	4.621
	STD DEV	.161	.154	.142	.083	.076
	SKEW	-.200	-.400	-.500	-.600	-.800
	INCRMT	0.	0.	0.	0.	0.
	EQUIV YRS	6.0	6.0	6.0	6.0	6.0
35	MEAN	4.520	4.401	4.297	4.070	3.873
	STD DEV	.194	.168	.162	.104	.082
	SKEW	-.200	-.400	-.500	-.600	-.800
	INCRMT	0.	0.	0.	0.	0.
	EQUIV YRS	6.0	6.0	6.0	6.0	6.0
33	MEAN	3.921	3.854	3.776	3.593	3.449
	STD DEV	.155	.131	.135	.088	.080
	SKEW	-.200	-.400	-.500	-.600	-.800
	INCRMT	0.	0.	0.	0.	0.
	EQUIV YRS	5.6	5.7	5.8	5.5	5.4

CORRELATION COEFFICIENTS OF RECORDED DATA FOR PEAK DURATION

STA	32	35	33
			WITH SAME DURATION
32	1.000	.599	.828
35	.599	1.000	.824
33	.828	.824	1.000
			WITH ADJACENT DURATION AT ABOVE STATION
32	.996	.520	.701
35	.652	.985	.911
33	.873	.730	.955

CORRELATION COEFFICIENTS OF RECORDED DATA FOR 1-DAY DURATION

STA	32	35	33
			WITH SAME DURATION
32	1.000	.579	.768
35	.579	1.000	.845
33	.768	.845	1.000
			WITH ADJACENT DURATION AT ABOVE STATION
32	.996	.652	.873
35	.520	.985	.730
33	.701	.911	.935

EXHIBIT 4

CORRELATION COEFFICIENTS OF RECORDED DATA FOR 3-DAY DURATION

STA	32	35	33
			WITH SAME DURATION
32	1.000	.588	.876
35	.588	1.000	.728
33	.876	.728	1.000
			WITH ADJACENT DURATION AT ABOVE STATION
32	.850	.867	.963
35	0.	.857	.674
33	.623	.781	.974

CORRELATION COEFFICIENTS OF RECORDED DATA FOR 10-DAY DURATION

STA	32	35	33
			WITH SAME DURATION
32	1.000	0.	.297
35	0.	1.000	.708
33	.297	.708	1.000
			WITH ADJACENT DURATION AT ABOVE STATION
32	.828	0.	.385
35	.383	.968	.666
33	.850	.783	.973

CORRELATION COEFFICIENTS OF RECORDED DATA FOR 30-DAY DURATION

STA	32	35	33
			WITH SAME DURATION
32	1.000	0.	.586
35	0.	1.000	.183
33	.586	.183	1.000
			WITH ADJACENT DURATION AT ABOVE STATION
32	.690	0.	.768
35	0.	.805	0.
33	0.	.706	.920

RECORDED AND RECONSTITUTED DATA

STA	YEAR	PEAK	1-DAY	3-DAY	10-DAY	30-DAY
33	1945	5530.	5040.	4100.	3320.	2270.
33	1946	13300.	9560.	7700.	4840.	3150.
33	1947	10300.	9360.	8530.	4850.	3540.
33	1948	10300.	8940.	6930.	4230.	2790.
33	1949	6470.	5400.	4300.	3120.	2330.
33	1950	6669.E	6246.E	6157.E	4151.E	3131.E

FREQUENCY STATISTICS OF RECORDED AND RECONSTITUTED DATA

STA	ITEM	PEAK	1-DAY	3-DAY	10-DAY	30-DAY
33	MEAN	3.921	3.855	3.782	3.605	3.452
	STD DEV	.149	.126	.132	.081	.077
	SKEW	.173	-.185	-.462	-.513	-.256
	EQUIV YRS	5.9	5.9	5.9	5.9	5.9

CORRELATION COEFFICIENTS OF RECORDED AND RECONSTITUTED DATA FOR PEAK DURATION

STA	32	35	33
			WITH SAME DURATION
32	1.000	.574	.855
35	.574	1.000	.853
33	.855	.853	1.000
			WITH ADJACENT DURATION AT ABOVE STATION
32	.995	.475	.739
35	.616	.986	.907
33	.887	.777	.959

EXHIBIT 4

CORRELATION COEFFICIENTS OF RECORDED AND RECONSTITUTED DATA FOR 1-DAY DURATION

STA	32	35	33
			WITH SAME DURATION
32	1.000	.526	.795
35	.526	1.000	.864
33	.795	.864	1.000
			WITH ADJACENT DURATION AT ABOVE STATION
32	.995	.616	.887
35	.475	.986	.777
33	.739	.907	.959

CORRELATION COEFFICIENTS OF RECORDED AND RECONSTITUTED DATA FOR 3-DAY DURATION

STA	32	35	33
			WITH SAME DURATION
32	1.000	.558	.904
35	.558	1.000	.647
33	.904	.647	1.000
			WITH ADJACENT DURATION AT ABOVE STATION
32	.836	.848	.964
35	0.	.875	.686
33	.604	.761	.941

CORRELATION COEFFICIENTS OF RECORDED AND RECONSTITUTED DATA FOR 10-DAY DURATION

STA	32	35	33
			WITH SAME DURATION
32	1.000	0.	.375
35	0.	1.000	.615
33	.375	.615	1.000
			WITH ADJACENT DURATION AT ABOVE STATION
32	.820	0.	.498
35	.365	.977	.561
33	.861	.709	.973

CORRELATION COEFFICIENTS OF RECORDED AND RECONSTITUTED DATA FOR 30-DAY DURATION

STA	32	35	33
			WITH SAME DURATION
32	1.000	0.	.740
35	0.	1.000	0.
33	.740	0.	1.000
			WITH ADJACENT DURATION AT ABOVE STATION
32	.744	0.	.751
35	0.	.819	0.
33	0.	.385	.923

FREQUENCY ARRAYS

STATION 33

NO	PLOT	PEAK	1-DAY	3-DAY	10-DAY	30-DAY
1	10.91	13300.	9560.	8530.	4850.	3540.
2	26.55	10300.	9360.	7700.	4840.	3150.
3	42.18	10300.	8840.	6930.	4230.	3131.E
4	57.82	6669.E	6246.E	6157.E	4151.E	2790.
5	73.45	6470.	5400.	4300.	3320.	2330.
6	89.09	5530.	5040.	4100.	3120.	2270.

ADOPTED FREQUENCY STATISTICS

STA	ITEM	PEAK	1-DAY	3-DAY	10-DAY	30-DAY
33	MEAN	3.921	3.855	3.782	3.605	3.452
	STD DEV	.145	.134	.123	.094	.070
	SKEW	-.200	-.400	-.500	-.600	-.800
	INCRMT	0.	0.	0.	0.	0.

COMPUTED FREQUENCY CURVES

STATION 33

PLOT	EXP PROB	PEAK	1-DAY	3-DAY	10-DAY	30-DAY
.01	.76	25133.	17617.	13090.	7011.	4046.
.10	1.88	21266.	15677.	11953.	6611.	3932.
1.00	4.30	17255.	13414.	10535.	6070.	3750.
5.00	9.72	14127.	11445.	9218.	5525.	3541.
10.00	14.72	12677.	10463.	8534.	5226.	3416.
30.00	32.66	9995.	8519.	7122.	4571.	3118.
50.00	50.00	8434.	7306.	6201.	4115.	2892.
70.00	67.34	7074.	6196.	5331.	3662.	2652.
90.00	85.28	5410.	4770.	4173.	3020.	2285.
95.00	90.28	4743.	4177.	3678.	2730.	2108.
99.00	95.70	3654.	3185.	2832.	2209.	1773.
99.90	98.12	2706.	2302.	2059.	1699.	1421.
99.99	99.24	2078.	1713.	1534.	1328.	1148.

EXHIBIT 4

****
JULY 1972 723-X6-L2350
REGIONAL FREQUENCY COMPUTATION
VERSION DATE - AUGUST 21, 1979
****

TEST DATA
723-X6-L2350
STATISTICS FURNISHED

NDUR	IYRA	ISKEW	KEEP	ICONV	IPCHQ	IPCHS	NSTAT	NSMTH	INCAD
5	1945	1	-0	-0	-0	-0	2	-1	-0

ADOPTED FREQUENCY STATISTICS

STA	ITEM	PEAK	1-DAY	3-DAY	10-DAY	30-DAY
32	MEAN	5.123	5.089	4.984	4.835	4.621
	STD DEV	.159	.153	.133	.106	.066
	SKEW	-.200	-.400	-.500	-.600	-.800
	INCRMT	0.	0.	0.	0.	0.
35	MEAN	4.518	4.408	4.267	4.052	3.843
	STD DEV	.196	.177	.153	.117	.092
	SKEW	-.200	-.400	-.500	-.600	-.800
	INCRMT	0.	0.	0.	0.	0.

REGIONAL SKEW COEFFICIENTS

PEAK	1-DAY	3-DAY	10-DAY	30-DAY
-.200	-.400	-.500	-.600	-.800

INPUT FREQUENCY STATISTICS

STA	ITEM	PEAK	1-DAY	3-DAY	10-DAY	30-DAY
32	MEAN	5.123	5.089	4.984	4.835	4.621
	STD DEV	.159	.153	.133	.106	.066
	SKEW	-.334	-.366	-.462	-.599	-.795
	INCRMT	0.	0.	0.	0.	0.
	EQUIV YRS	6.0	6.0	6.0	6.0	6.0
35	MEAN	4.518	4.408	4.267	4.052	3.843
	STD DEV	.196	.177	.153	.117	.082
	SKEW	-.278	-.168	-.027	.188	.398
	INCRMT	0.	0.	0.	0.	0.
	EQUIV YRS	5.6	6.0	6.0	5.8	5.9

EXHIBIT 4

COMPUTED FREQUENCY CURVES

STATION 32

PLOT	EXP PROB	PEAK	1-DAY	3-DAY	10-DAY	30-DAY
.01	.74	446115.	342977.	222370.	127450.	58504.
.10	1.84	371280.	300235.	201503.	119328.	56939.
1.00	4.25	295084.	251317.	175691.	108407.	54454.
5.00	9.65	236862.	209670.	152007.	97546.	51588.
10.00	14.65	210287.	169276.	139799.	91627.	49866.
30.00	32.63	161945.	149725.	114888.	78837.	45759.
50.00	50.00	134367.	125648.	98857.	70064.	42623.
70.00	67.37	110754.	104117.	83904.	61459.	39277.
90.00	85.35	82495.	77257.	64335.	49497.	34132.
95.00	90.35	71386.	66397.	56098.	44191.	31641.
99.00	95.75	53600.	48734.	42243.	34833.	26879.
99.90	98.16	38529.	33646.	29892.	25933.	21818.
99.99	99.26	28829.	24015.	21711.	19663.	17848.

STATION 35

PLOT	EXP PROB	PEAK	1-DAY	3-DAY	10-DAY	30-DAY
.01	.77	146877.	83998.	48381.	22408.	10583.
.10	1.91	117125.	72011.	43196.	20837.	10233.
1.00	4.34	88243.	58619.	36894.	18742.	9681.
5.00	9.77	67301.	47535.	31233.	16681.	9052.
10.00	14.77	58118.	42228.	28365.	15567.	8678.
30.00	32.69	42118.	32198.	22633.	13187.	7799.
50.00	50.00	33460.	26287.	19040.	11577.	7141.
70.00	67.31	26367.	21150.	15766.	10018.	6451.
90.00	85.23	18338.	14976.	11616.	7889.	5418.
95.00	90.23	15344.	12569.	9922.	6961.	4931.
99.00	95.66	10777.	8788.	7160.	5353.	4027.
99.90	98.09	7174.	5725.	4809.	3865.	3108.
99.99	99.23	5018.	3876.	3329.	2648.	2421.

EXHIBIT 5

DEFINITIONS 723-X6-L7350

AA(I) - First half of description for duration I
AB(I) - Second half
ABS - Computer library function for absolute value of number
ALOG - Computer library function for natural logarithm
ANYR(I,K) - Number of years of data for station K and duration I
ANYRS - Number of years of data in study
AV(I,K) - Mean logarithm (or sum of logarithms) for station K and duration I
AVGSK - Average regional skew coefficient
B(K) - Regression coefficient for variable (K)
BB - Regression coefficient
BC - Regression coefficient
BLANK - Symbol to identify recorded data
CB - Regression constant
CC - Regression constant
CROUT - Program subroutine to solve simultaneous equations
DQ(I,K) - Increment added to all flows for duration I at station K to preclude infinite negative logarithms
DTRMC - Multiple determination coefficient
E - Symbol to identify reconstituted data
I - Index for duration
IA - Indicator in column 1 of first card for each job
ICORL - Indicator, when positive calls for computation of correlation coefficients
ICSE - Indicator, case number specifing cause for no independent variables in estimation equation
+1 indicates no flows found for correlation
+2 indicates all correlations were zero
II - Index associated with I
INCAD - Indicator, positive value calls for adjustment of increment to reduce skew coefficient
INDC - Indicator positive when correlation coefficient has been changed
IPCHQ - Indicator, when positive calls for punching recorded and reconstituted flows
IPCHS - Indicator, when positive calls for punching statistics
IPREV - Order number in regression equation of adjacent duration
IRCRD(J) - Indicator blank when no record at all stations in year J
IRATO - Indicator, when positive calls for reading conversion ratios
ISKEW - Indicator when positive calls for reading skew coefficients

ISTA(K) - Identification number for station K
ISTAN - Station number
ISTN - Array of station sequence by length of record; longest record first
ISTY - Array of station record lengths used to build ISTN array
ITEMP - Temporary variable
ITMP - Temporary variable
ITP - Temporary variable
IX - Index associated with I
IXX - Argument for random number function
IYR - Year number
IYRA - Number of earliest year of record
J - Year index
JA - Index associated with J
JX - Index associated with J
K - Station index
KDUR - Dimension limit for durations
KEEP - Number stations to keep from immediately previous job
KEPT(K) - Station numbers kept from immediately previous job
KRCRD - Indicator, when positive a complete record exists for all stations
KSTA - Dimension limit for stations
KX - Index associated with K
KYRS - Dimension limit for years
L - Subordinate station index
LA - Index associated with L
LTRA - Letter A for testing IA
LX - Index associated with L
M - Sequence index
MM - Index associated with M
N - Temporary counter
NCAB(I,K) - Number of cross products for station K and duration I
NDUR - Number of durations in study
NINDP - Number of independent variables in correlation
NLOG(I,K) - Number of values for station K and duration I
NSMTH - Indicator, zero or positive value causes smoothing of statistics
NSTA - Number of stations in study
NSTAT - Number of stations for which statistics (instead of flows) are supplied
NSTAX - Twice NSTA
NSTXX - Number of stations kept from previous job incremented by 1
NVAR - Total number of variables in correlation
NYDIF - Indicator, when positive a difference in record length exists between new data and data from previous job
NYRS - Number of years in study

P(I) - Exceedence frequency coordinate or ratio to convert flows to average rates
PLTT(J) - Plotting position for event number J
Q(M,K) - Flow or logarithm for station K and sequence number M
QM(I) - Flow for current station and year and for duration I
QR(M,K) - Indicator whether Q(M,K) is recorded or reconstituted
R(K,K+1) - Covariance array for multiple regression equation
RA(I,K,L) - Correlation between stations K and L for duration I
RMAX - Maximum consistent correlation coefficient
RMIN - Minimum consistent correlation coefficient
SA - Sum of mean logarithms for various durations
SAA - Sum of squares of mean logarithms
SAB - Sum of cross products of mean logarithm and standard deviation
SAC - Sum of cross products of mean logarithm and skew coefficient
SB - Sum of standard deviations for various durations
SC - Sum of skew coefficients for various durations
SD(I,K) - Standard deviation (or sum of squares) for station K and duration I
SDA - Standard deviation of short record station
SDB - Standard deviation of long record station
SIN - Computer library function for sine
SKEW(I,K) - Skew coefficient (or sum of cubes) for station K and duration I
SKW(I) - Specified skew coefficient for duration I at all stations
SQA(I,K) - Sum of squares of logarithms in correlation for station K and duration I
SQB(I,K) - Sum of squares of logarithms at related station in correlation with station K for duration I
SUMA(I,K) - Sum of logarithms in correlation for station K and duration I
SUMB(I,K) - Sum of logarithms at related station in correlation with station K for duration I
T - Large number denoting missing record
TEMP - Temporary variable
TMP - Temporary variable
TMPA - Temporary variable
TMPB - Temporary variable
TMPP - Temporary variable
TP - Temporary variable
X(K) - Independent variable related to station K
XINCR(I,K) - Increment for DQ in skew coefficient adjustment routine
XPAB(I,K) - Sum of cross products of logarithms for station K with related station for duration I
XQ(I) - Temporary flow array

SOURCE PROGRAM

```
C         723-X6-L7350  REGIONAL FREQUENCY COMPUTATION, HEC, JULY 1972   1001
C     LIBRARY SUBROUTINES USED--ALOG,SIN,ABS                             1002
C     PROGRAM SUBROUTINES CROUT,RNGEN--SEE COMMENTS IN RNGEN             1003
C     REFERENCE TO TAPE 7 AT 960+1,1170+6                                1004
C     INDEXES I=DURATION  J=YEAR  K=STATION  L=RELATED STA M=SEQUENCE NO 1005
C                                                                        1006
      DIMENSION                                                          1007
     1AA(8),AB(8),ANYR(8,10),AV(8,10),B(10),DQ(8,10),                    1008
     2IRCRD(100),ISTA(10),ISTN(10),ISTY(10),KEPT(10),NCA8(8,10,20),      1009
     3NLOG(8,10),P(8),PLTT(100),Q(400,10),QM(400),QMIN(8,10),           1010
     4QR(400,10),R(10,11),RA(8,10,20),SD(8,10),SKEW(8,10),SKW(8),       1011
     5SQA(8,10,20),SQB(8,10,20),SUMA(8,10,20),SUMB(8,10,20),X(400),     1012
     6XINCR(8,10),XPAB(8,10,20),XQ(8)                                   1013
      COMMON DTRMC,NINOP,B                                              1014
      DATA LTRA/1HA/,BLANK/1H /,E/1HE/                                  1015
      KSTA=10                                                           1016
      KDUR=8                                                            1017
      KYRS=50                                                           1018
   10 FORMAT(1X,I7,9I8)                                                 1019
   20 FORMAT(1X,F7.0,9F8.0)                                             1020
   30 FORMAT(A1,A3,9A4,10A4)                                            1021
   40 FORMAT(1X,A3,9A4,10A4)                                            1022
   50 FORMAT(1H1)                                                       1023
   60 FORMAT(1X,I7,I8,8F8.0)                                            1024
   70 FORMAT (2X,A3,A4,F9.3)                                            1025
   80 FORMAT (1X,2A4,F9.3)                                              1026
      DO 90 K=1,KSTA                                                    1027
   90 ISTA(K)=-1                                                        1028
      IYRSV=0                                                           1029
C              WASTE CARDS UNTIL AN A IN COL 1, FIRST TITLE CARD         1030
C                                              ** CARD A-1 **           1031
  100 READ(5,30)IA,(QR(J,1),J=1,20)                                     1032
      IF (IA.NE.LTRA) GO TO 100                                         1033
C                                              ** CARD A-2,3 **         1034
      READ(5,40)((QR(J,K),J=1,20),K=2,3)                                1035
C                                              ** CARD B **             1036
      READ(5,10) NDUR,IYRA,ISKEW,KEEP,ICONV,IPCHQ,IPCHS,NSTAT,NSMTH,    1037
     1INCAD                                                             1038
C              TERMINATE WITH 4 BLANK CARDS, AN A IN COL 1 OF FIRST      1039
      IF(NDUR.LE.0) STOP                                                1040
      WRITE(6,50)                                                       1041
      WRITE(6,110)                                                      1042
  110 FORMAT(1X,30(1H*)/10H JULY 1972,9X,12H723-X6-L2350/9H REGIONAL,   1043
     $    22H FREQUENCY COMPUTATION/31H VERSION DATE - AUGUST 21, 1979/  1044
     $    1X,30(1H*)///)                                               10441
      WRITE(6,40)((QR(J,K),J=1,20),K=1,3)                               1045
      IF(NDUR.LE.KDUR)GO TO 140                                         1046
  120 WRITE(6,130) NSTA,NDUR,KYRS                                       1047
  130 FORMAT(/19H DIMENSION EXCEEDED ,5X,5HNSTA=,I3,5X,5HNDUR=,I2,5X,5HN 1048
     1YRS=,I4)                                                          1049
      GO TO 100                                                         1050
  140 WRITE(6,150) NDUR,IYRA,ISKEW,KEEP,ICONV,IPCHQ,IPCHS,NSTAT,NSMTH,  1051
     1INCAD                                                             1052
  150 FORMAT(/6X,4HNDUR,6X,4HIYRA,5X,5HISKEW,6X,4HKEEP,5X,5HICONV,5X,5HI 1053
     1PCHQ,5X,5HIPCHS,5X,5HNSTAT,5X,5HNSMTH,5X,5HINCAD,/10I10)          1054
C                                              ** CARD C **             1055
      READ(5,40)(AA(I),AB(I),I=1,NDUR)                                  1056
      IF(ISKEW.LE.0)GO TO 200                                           1057
      AVGSK=0.                                                          1058
C                                              ** CARD D **             1059
      READ(5,20)(SKW(I),I=1,NDUR)                                       1060
      WRITE(6,160)                                                      1061
  160 FORMAT(/27H REGIONAL SKEW COEFFICIENTS)                           1062
      WRITE(6,170) (AA(I),AB(I),I=1,NDUR)                               1063
  170 FORMAT(20X,A3,A4,7(3X,2A4))                                       1064
      WRITE(6,180) (SKW(I),I=1,NDUR)                                    1065
  180 FORMAT(16X,10F11.3)                                               1066
      DO 190 I=1,NDUR                                                   1067
  190 AVGSK=AVGSK+SKW(I)                                                1068
```


EXHIBIT 6

```
      TEMP=NDUR                                                          1069
      AVGSK=AVGSK/TEMP                                                   1070
  200 T=99999999.                                                        1071
      IXX=0                                                              1072
      IYRA=IYRA+1                                                        1073
      NSTA=NSTAT                                                         1074
      IF(NSTAT.GT.10) NSTA=10                                            1075
      NSTXX=1                                                            1076
      IF(NSTAT.GT.0) GO TO 300                                           1077
      NSTA=0                                                             1078
      INDC=0                                                             1079
      NYDIF=0                                                            1080
C               INITIATE -1, NO RECORD FOR ALL FLOWS                     1081
      ITP=KDUR*KYRS                                                      1082
      DO 210 K=1,KSTA                                                    1083
      DO 210 N=1,ITP                                                     1084
      QR(N,K)=(-1.)                                                      1085
  210 CONTINUE                                                           1086
      IF(KEEP.LE.0) GO TO 300                                            1087
C               SAVE STATIONS FROM PREVIOUS RUN IF NECESSARY             1088
C                                                    ** CARD E **        1089
      READ(5,10) (KEPT(I),I=1,KEEP)                                      1090
      WRITE(6,220) (KEPT(I),I=1,KEEP)                                    1091
  220 FORMAT(/31H  STATION(S) KEPT FROM LAST RUN ,14(1H,I6)/31X6(1H,I6)) 1092
      DO 280 K=1,KSTA                                                    1093
      DO 270 L=1,KEEP                                                    1094
      IF(KEPT(L).NE.ISTA(K)) GO TO 270                                   1095
      INDC=1                                                             1096
      NSTA=NSTA+1                                                        1097
      ISTA(NSTA)=ISTA(K)                                                 1098
      DO 230 I=1,NDUR                                                    1099
      NLOG(I,NSTA)=0                                                     1100
      QQ(I,NSTA)=QQ(I,K)                                                 1101
      XINCR(I,NSTA)=XINCR(I,K)                                           1102
  230 CONTINUE                                                           1103
      M=0                                                                1104
      ITMP=IYRSV-IYRA                                                    1105
      MM=ITMP*NDUR                                                       1106
      ITP=IYRA-IYRSV+1                                                   1107
      IF(ITP.LE.0) ITP=1                                                 1108
      IF(MM.GE.0) GO TO 240                                              1109
      M=-MM                                                              1110
      MM=0                                                               1111
  240 DO 260 J=ITP,NYRS                                                  1112
      DO 250 I=1,NDUR                                                    1113
      M=M+1                                                              1114
      MM=MM+1                                                            1115
      IF(IRCRD(J).LE.0) GO TO 250                                        1116
      TMP=Q(M,K)                                                         1117
      IF(TMP.GE.T) GO TO 250                                             1118
      QR(MM,NSTA)=TMP                                                    1119
      NLOG(I,NSTA)=NLOG(I,NSTA)+1                                        1120
  250 CONTINUE                                                           1121
  260 CONTINUE                                                           1122
      GO TO 280                                                          1123
  270 CONTINUE                                                           1124
  280 CONTINUE                                                           1125
      IF(ITMP.NE.0) NYDIF=1                                              1126
      NYRS=NYRS+ITMP                                                     1127
      NSTXX=NSTA+1                                                       11271
      IF(NSTA.EQ.KEEP) GO TO 300                                         1128
      ITP=KEEP-NSTA                                                      1129
      WRITE(6,290) ITP                                                   1130
  290 FORMAT(17H NOT ABLE TO FIND,I3,9HSTATIONS )                        1131
      KEEP=NSTA                                                          1132
  300 IF(INDC.LT.1) NYRS=0                                               1133
      IF(ICONV.LE.0) GO TO 320                                           1134
C                                                    ** CARD F **        1135
      READ (5,20)(P(I),I=1,NDUR)                                         1136
      WRITE (6,310)                                                      1137
```

```
  310 FORMAT (/30H RATIOS TO OBTAIN RATE OF FLOW)                        1138
      WRITE(6,170) (AA(I),AB(I),I=1,NDUR)                               1139
      WRITE(6,180)(P(I),I=1,NDUR)                                       1140
      GO TO 340                                                         1141
  320 DO 330 I=1,NDUR                                                   1142
      P(I)= 1.                                                          1143
  330 CONTINUE                                                          1144
C             SET CONSTANTS                                             1145
  340 IF(NSTAT.GT.0) GO TO 2140                                         1146
      DO 350 K=NSTXX,KSTA                                               1147
      ISTA(K)=-1                                                        1148
  350 CONTINUE                                                          1149
      IYRSV=IYRA                                                        1150
      ITP=KDUR*KYRS/NDUR                                                1151
      DO 390 K=1,KSTA                                                   1152
      DO 380 I=1,NDUR                                                   1153
      IF(K.LT.NSTXX) GO TO 360                                          1154
      NLOG(I,K)=0                                                       1155
      DQ(I,K)=0.                                                        1156
  360 DO 370 J=1,ITP                                                    1157
      N=NDUR*(J-1)+I                                                    1158
      Q(N,K)=QR(N,K)                                                    1159
  370 CONTINUE                                                          1160
  380 CONTINUE                                                          1161
  390 CONTINUE                                                          1162
C  * * * * * * READ AND PROCESS ONE STATION-YEAR OF DATA * * * * * * * * 1163
C                                                  ** CARD G **         1164
  400 READ(5,60)ISTAN,IYR,(QM(I),I=1,NDUR)                              1165
C                                                  ** CARD H **         1166
C             BLANK CARD INDICATES END OF FLOW DATA                     1167
      IF(ISTAN.LT.1)GO TO 470                                           1168
      IF(NSTA.LT.1)GO TO 420                                            1169
      DO 410 K=1,NSTA                                                   1170
C             IDENTIFY STATION SUBSCRIPT                                1171
      IF(ISTAN.EQ.ISTA(K))GO TO 430                                     1172
  410 CONTINUE                                                          1173
  420 NSTA=NSTA+1                                                       1174
C             ASSIGN SUBSCRIPT TO NEW STATION                           1175
      IF(NSTA.GT.KSTA) GO TO 120                                        1176
      K=NSTA                                                            1177
      ISTA(K)=ISTAN                                                     1178
C             ASSIGN SUBSCRIPT TO YEAR                                  1179
  430 J=IYR-IYRA                                                        1180
      IF(NYRS.LT.J)NYRS=J                                               1181
      IF(J.GT.0)GO TO 450                                               1182
      WRITE(6,440)IYR                                                   1183
  440 FORMAT(/18H UNACCEPTABLE YEAR I5)                                 1184
      GO TO 100                                                         1185
C             STORE FLOWS IN STATION AND DURATION ARRAY                 1186
  450 M=(J-1)*NDUR                                                      1187
      DO 460 I=1,NDUR                                                   1188
      M=M+1                                                             1189
      IF(QM(I).LE.(-1.)) GO TO 460                                      1190
      NLOG(I,K)=NLOG(I,K)+1                                             1191
      DQ(I,K)=DQ(I,K)+QM(I)                                             1192
      Q(M,K)=QM(I)                                                      1193
  460 CONTINUE                                                          1194
      GO TO 400                                                         1195
  470 IF(NYRS*NDUR.GT.KYRS*KDUR) GO TO 120                              1196
C  * * * * * * COMPUTE FREQUENCY STATISTICS  * * * * * * * * * * * * * * 1197
      WRITE(6,480)                                                      1198
  480 FORMAT(/38H FREQUENCY STATISTICS OF RECORDED DATA )                1199
      WRITE(6,490)(AA(I),AB(I),I=1,NDUR)                                1200
  490 FORMAT(5X,12HSTA     ITEM 3X,A3,A4,7(3X,2A4))                     1201
      DO 500 J=1,NYRS                                                   1202
  500 IRCRD(J)=0                                                        1203
      KRCRD=1                                                           1204
      ICORL=1                                                           1205
      IF(NDUR.EQ.1.AND.NSTA.EQ.1) ICORL=0                               1206
```

```
      INDC=0                                                            1207
      DO 710 K=1,NSTA                                                   1208
      TMPP=T                                                            1209
      XMIN=T                                                            1210
      DO 520 I=1,NDUR                                                   1211
      N=0                                                               1212
      IF(K.LT.NSTXX) GO TO 550                                          1213
      TEMP=T                                                            1214
      M=I-NDUR                                                          1215
      DO 510 J=1,NYRS                                                   1216
      M=M+NDUR                                                          1217
      TMP=Q(M,K)                                                        1218
      IF(TMP.LE.(-1.)) GO TO 510                                        1219
      IF(TMP.LT.TEMP) TEMP=TMP                                          1220
  510 CONTINUE                                                          1221
      QMIN(I,K)=TEMP                                                    1222
      IF(TEMP.LT.TMPP) TMPP=TEMP                                        1223
      TEMP=NLOG(I,K)                                                    1224
      IF (TEMP.LT.0.1) GO TO 520                                        1225
      DQ(I,K)=DQ(I,K)*.001/TEMP                                         1226
      IF(DQ(I,K).LT. .001) DQ(I,K)= .001                                1227
      TEMP=(QMIN(I,K)+DQ(I,K))/DQ(I,K)                                  1228
      IF(TEMP.LT.XMIN) XMIN=TEMP                                        1229
  520 CONTINUE                                                          1230
      DO 540 I=1,NDUR                                                   1231
      IF(NLOG(I,K).LE.0) GO TO 530                                      1232
      XINCR(I,K)=XMIN/16.*DQ(I,K)                                       1233
      IF(XINCR(I,K).LT..01) XINCR(I,K)=.01                              1234
  530 IF(TMPP.GT.0..AND.INCA0.LE.0) DQ(I,K)=0.                          1235
  540 CONTINUE                                                          1236
  550 DO 560 I=1,NDUR                                                   1237
      ANYR(I,K)=0.                                                      1238
      AV(I,K)=0.                                                        1239
      SD(I,K)=0.                                                        1240
      SKEW(I,K)=0.                                                      1241
  560 CONTINUE                                                          1242
      M=0                                                               1243
      DO 590 J=1,NYRS                                                   1244
      DO 580 I=1,NDUR                                                   1245
      M=M+1                                                             1246
      IF(Q(M,K).LT.(-.1)) GO TO 570                                     1247
      IRCRD(J)=1                                                        1248
      QR(M,K)=BLANK                                                     1249
      ANYR(I,K)=ANYR(I,K)+1.                                            1250
C               REPLACE FLOW ARRAY WITH LOG ARRAY                       1251
      TEMP=ALOG(Q(M,K)+DQ(I,K))*.4342945                                1252
      IF(ICORL.EQ.1) Q(M,K)=TEMP                                        1253
C               SUM, SQUARES AND CUBES                                  1254
      AV(I,K)=AV(I,K)+TEMP                                              1255
      SD(I,K)=SD(I,K)+TEMP*TEMP                                         1256
      SKEW(I,K)=SKEW(I,K)+TEMP*TEMP*TEMP                                1257
      GO TO 580                                                         1258
C               MISSING FLOWS EQUATED TO T                              1259
  570 Q(M,K)=T                                                          1260
      QR(M,K)=E                                                         1261
      KRCRD=0                                                           1262
  580 CONTINUE                                                          1263
  590 CONTINUE                                                          1264
      SUM=0.                                                            1265
      DO 620 I=1,NDUR                                                   1266
      TEMP=NLOG(I,K)                                                    1267
      IF (TEMP.LT.0.5) GO TO 620                                        1268
      TMP=AV(I,K)                                                       1269
      AV(I,K)=TMP/TEMP                                                  1270
      IF (SD(I,K).LE.0.0.OR.TEMP.LT.2.5) GO TO 600                      1271
      TMPA=SD(I,K)                                                      1272
      SD(I,K)=(SD(I,K)-AV(I,K)*TMP)/(TEMP-1.)                           1273
      IF(SD(I,K).LE.0.) GO TO 600                                       1274
      SD(I,K)=SD(I,K)**.5                                               1275
```


EXHIBIT 6

```
      SKEW(I,K)=(TEMP*TEMP*SKEW(I,K)-3.*TEMP*TMP*TMPA+2.*TMP*TMP*TMP)/   1276
     1(TEMP*(TEMP-1.)*(TEMP-2.)*SD(I,K)**3)                              1277
      GO TO 610                                                          1278
  600 SD(I,K)=0.                                                         1279
      SKEW(I,K)=0.                                                       1280
  610 SUM=SUM+SKEW(I,K)                                                  1281
  620 CONTINUE                                                           1282
      TEMP=NDUR                                                          1283
      SUM=SUM/TEMP                                                       1284
      N=N+1                                                              1285
      IF(K.LT.NSTXX.AND.NYDIF.EQ.0) GO TO 710                            1286
      IF(N.GT.1)GO TO 630                                                1287
C               PRINT FREQUENCY STATISTICS                               1288
      WRITE(6,1070)ISTA(K),(AV(I,K),I=1,NDUR)                            1289
      WRITE(6,1080)(SD(I,K),I=1,NDUR)                                    1290
      WRITE(6,1090)(SKEW(I,K),I=1,NDUR)                                  1291
      WRITE(6,1100)(DQ(I,K),I=1,NDUR)                                    1292
      WRITE(6,1110)(ANYR(I,K),I=1,NDUR)                                  1293
      IF(ISKEW.LE.0.OR.INCAD.LE.0) GO TO 710                             1294
  630 IF(N.GE.16) GO TO 710                                              1295
      IF(SUM.GT.(AVGSK-.1).AND.SUM.LT.(AVG3K+.1)) GO TO 710              1296
      INDC=1                                                             1297
      M=0                                                                1298
      DO 660 J=1,NYRS                                                    1299
      DO 650 I=1,NDUR                                                    1300
      M=M+1                                                              1301
      IF(Q(M,K).GE.T)  GO TO 640                                         1302
      TEMP=Q(M,K)                                                        1303
      Q(M,K)=10.**TEMP-DQ(I,K)                                           1304
      GO TO 650                                                          1305
  640 Q(M,K)=-1.                                                         1306
  650 CONTINUE                                                           1307
  660 CONTINUE                                                           1308
      IF(SUM-AVGSK) 670,710,690                                          1309
  670 DO 680 I=1,NDUR                                                    1310
      IF(NLOG(I,K).LE.0) GO TO 680                                       1311
      DQ(I,K)=DQ(I,K)*1.5                                                1312
  680 CONTINUE                                                           1313
      GO TO 550                                                          1314
  690 DO 700 I=1,NDUR                                                    1315
      IF(NLOG(I,K).LE.0) GO TO 700                                       1316
      DQ(I,K)=DQ(I,K)-XINCR(I,K)                                         1317
  700 CONTINUE                                                           1318
      GO TO 550                                                          1319
  710 CONTINUE                                                           1320
      IF(NYDIF.GT.0) NSTXX=1                                             1321
      NSTAX=NSTA+NSTA                                                    1322
      IF (NDUR.EQ.1) NSTAX=NSTA                                          1323
C               OMIT CORRELATIONS IF ONLY 1 STA AND 1 DURATION           1324
      ITRNS=0                                                            1325
      IF(ICORL.EQ.1) GO TO 730                                           1326
      M=0                                                                1327
      ANYRS=0.                                                           1328
      DO 720 J=1,NYRS                                                    1329
      M=M+1                                                              1330
      IF (Q(J,1).GE.T) GO TO 720                                         1331
      ANYRS=ANYRS+1.                                                     1332
      QP(M,1)=BLANK                                                      1333
      IRCRD(M)=1                                                         1334
  720 CONTINUE                                                           1335
      GO TO 1760                                                         1336
C               OMIT CORRELATIONS IF NO MISSING FLOWS                    1337
  730 IF(KRCRD.EQ.1) GO TO 1130                                          1338
C  * * * * * * COMPUTE SUMS OF SQUARES AND CROSS PRODUCTS  * * * * * * * 1339
  740 DO 760 K=1,NSTA                                                    1340
      DO 750 I=1,NDUR                                                    1341
      DO 750 L=1,NSTAX                                                   1342
      RA(I,K,L)=-4.                                                      1343
      SUMA(I,K,L)=0.                                                     1344
      SUMB(I,K,L)=0.                                                     1345
```

```
      SQA(I,K,L)=0.                                                     1346
      SQB(I,K,L)=0.                                                     1347
      XPAB(I,K,L)=0.                                                    1348
      NCAB(I,K,L)=0                                                     1349
  750 CONTINUE                                                          1350
  760 CONTINUE                                                          1351
      DO 900 K=1,NSTA                                                   1352
      KX=K+1                                                            1353
      IF(KX.GT.NSTAX) GO TO 820                                         1354
      M=0                                                               1355
      DO 810 J=1,NYRS                                                   1356
      DO 800 I=1,NDUR                                                   1357
      M=M+1                                                             1358
      TEMP=Q(M,K)                                                       1359
      IF(TEMP.GE.T)GO TO 800                                            1360
      IF(ITRNS.EQ.1) TEMP=ALOG(TEMP+DQ(I,K))*.4342945                   1361
      DO 790 L=K,NSTAX                                                  1362
C               SUBSCRIPTS EXCEEDING NSTA RELATE TO ADJACENT DURATION   1363
      IF(L.LE.NSTA)GO TO 770                                            1364
      LX=L-NSTA                                                         1365
      IF (I.EQ.1) TMP=Q(M+1,LX)                                         1366
      IF(I.GT.1)TMP=Q(M-1,LX)                                           1367
      IF(TMP.GE.T)GO TO 790                                             1368
      IF(ITRNS.EQ.1) TMP=ALOG(TMP+DQ(I,LX))*.4342945                    1369
      GO TO 780                                                         1370
  770 TMP=Q(M,L)                                                        1371
      IF(TMP.GE.T)GO TO 790                                             1372
      IF(ITRNS.EQ.1) TMP=ALOG(TMP+DQ(I,L))*.4342945                     1373
C               COUNT AND USE ONLY RECORDED PAIRS                       1374
  780 NCAB(I,K,L)=NCAB(I,K,L)+1                                         1375
      SUMA(I,K,L)=SUMA(I,K,L)+TEMP                                      1376
      SUMB(I,K,L)=SUMB(I,K,L)+TMP                                       1377
      SQA (I,K,L)=SQA (I,K,L)+TEMP*TEMP                                 1378
      SQB (I,K,L)=SQB (I,K,L)+TMP*TMP                                   1379
      XPAB(I,K,L)=XPAB(I,K,L)+TEMP*TMP                                  1380
      IF(L.GT.NSTA) GO TO 790                                           1381
      NCAB(I,L,K)=NCAB(I,K,L)                                           1382
      SUMA(I,L,K)=SUMB(I,K,L)                                           1383
      SUMB(I,L,K)=SUMA(I,K,L)                                           1384
      SQA (I,L,K)=SQB (I,K,L)                                           1385
      SQB (I,L,K)=SQA (I,K,L)                                           1386
      XPAB(I,L,K)=XPAB(I,K,L)                                           1387
  790 CONTINUE                                                          1388
  800 CONTINUE                                                          1389
  810 CONTINUE                                                          1390
C  * * * * * * COMPUTE CORRELATION COEFFICIENTS  * * * * * * * * * * * 1391
      ITMP=0                                                            1392
  820 DO 890 I=1,NDUR                                                   1393
C               SEARCH FOR DURATION WITH LONGEST RECORD                 1394
      ITEMP=NLOG(I,K)                                                   1395
      IF(ITEMP.LE.ITMP) GO TO 830                                       1396
      ITMP=ITEMP                                                        1397
      IX=I                                                              1398
  830 IF(KX.GT.NSTAX) GO TO 870                                         1399
      DO 860 L=KX,NSTAX                                                 1400
C               ELIMINATE PAIRS WITH LESS THAN 3 YRS DATA               1401
      IF(NCAB(I,K,L).LE.2) GO TO 840                                    1402
      TEMP=NCAB(I,K,L)                                                  1403
      SA=SUMA(I,K,L)                                                    1404
      SB=SUMB(I,K,L)                                                    1405
      TMP=(SQA(I,K,L)-SA**2/TEMP)*(SQB(I,K,L)-SB**2/TEMP)               1406
      IF(TMP.LE.0.) GO TO 850                                           1407
      TMPB=1.                                                           1408
      TMPA=XPAB(I,K,L)-SA*SB/TEMP                                       1409
      IF(TMPA.LT.0.)TMPB=-TMPB                                          1410
      TMPA=TMPA*TMPA/TMP                                                1411
      TMPA=1.-(1.-TMPA)*(TEMP-1.)/(TEMP-2.)                             1412
      IF(TMPA.LT.0.)TMPA=0.                                             1413
      RA(I,K,L)=TMPB*TMPA**.5                                           1414
```


EXHIBIT 6

```
  840 IF(L.GT.NSTA) GO TO 860                                          1415
      RA(I,L,K)=RA(I,K,L)                                              1416
      GO TO 860                                                        1417
  850 RA(I,K,L)=0.                                                     1418
  860 CONTINUE                                                         1419
C                 ELIMINATE NEGATIVE GROSS CORRELATIONS              1420
  870 DO 880 L=1,NSTAX                                                 1421
      TEMP=RA(I,K,L)                                                   1422
      IF (TEMP.LT.0.0.AND.TEMP.GE.(-1.0)) RA(I,K,L)=0.                 1423
  880 CONTINUE                                                         1424
      RA(I,K,K)=1.                                                     1425
  890 CONTINUE                                                         1426
  900 CONTINUE                                                         1427
      IF(ITRNS.NE.0) GO TO 1270                                        1428
C * * * * * *  ADJUSTMENT OF FREQUENCY STATISTICS TO LONG TERM       1429
      DO 980 II=1,NDUR                                                 1430
      I=IX+II-1                                                        1431
      IF(I.GT.NDUR)I=NDUR-II+1                                         1432
      DO 910 K=1,NSTA                                                  1433
      ISTN(K)=K                                                        1434
      ISTY(K)=NLOG(I,K)                                                1435
  910 CONTINUE                                                         1436
C                 ARRAY STATIONS - LONGEST RECORD FIRST,ETC           1437
      ITMP=NSTA-1                                                      1438
      IF(ITMP.LE.0) GO TO 985                                          14381
      DO 930 KX=1,ITMP                                                 1439
      ITP=KX+1                                                         1440
      DO 920 K=ITP,NSTA                                                1441
      IF(ISTY(KX).GT.ISTY(K)) GO TO 920                                1442
      ITEMP=ISTN(KX)                                                   1443
      ISTN(KX)=ISTN(K)                                                 1444
      ISTN(K)=ITEMP                                                    1445
      ITEMP=ISTY(KX)                                                   1446
      ISTY(KX)=ISTY(K)                                                 1447
      ISTY(K)=ITEMP                                                    1448
  920 CONTINUE                                                         1449
  930 CONTINUE                                                         1450
      DO 970 KX=1,NSTA                                                 1451
      K=ISTN(KX)                                                       1452
      TMPB=NLOG(I,K)                                                   1453
      INDC=0                                                           1454
      DO 960 LX=1,KX                                                   1455
      IF(LX.EQ.KX) GO TO 940                                           1456
      ITP=I                                                            1457
      L=ISTN(LX)                                                       1458
      TMP=NLOG(I,L)                                                    1459
      TMPP=NCAB(I,K,L)                                                 1460
      GO TO 950                                                        1461
  940 IF(NDUR.EQ.1) GO TO 960                                          1462
      ITP=I-1                                                          1463
      IF(ITP.LE.0)ITP=I+1                                              1464
      L=K+NSTA                                                         1465
      TMP=NLOG(ITP,K)                                                  1466
      TMPP=NCAB(I,K,L)                                                 1467
  950 TP=RA(I,K,L)                                                     1468
      IF(TP.LT.(-1.)) GO TO 960                                        1469
      TMPA=TMPP/(1.-(TMP-TMPP)*TP**2/TMP)                              1470
      IF(TMPA.LT.TMPB) GO TO 960                                       1471
      INDC=1                                                           1472
      ANYR(I,K)=TMPA                                                   1473
      TMPB=TMPA                                                        1474
      ITMP=L                                                           1475
      ITEMP=ITP                                                        1476
  960 CONTINUE                                                         1477
      IF(INDC.LE.0) GO TO 970                                          1478
      L=ITMP                                                           1479
      ITP=ITEMP                                                        1480
      LX=L                                                             1481
      IF(LX.GT.NSTA) LX=LX-NSTA                                        1482
      TP=RA(I,K,L)                                                     1483
      TEMP=NCAB(I,K,L)                                                 1484
```


EXHIBIT 6

```
      SA=SUMA(I,K,L)                                                    1485
      SB=SUMB(I,K,L)                                                    1486
      SDA=(SQA(I,K,L)-SA**2/TEMP)/(TEMP-1.)                             1487
      IF(SDA.LT.0.) SDA=0.                                              1488
      SDA=SDA**.5                                                       1489
      SDB=(SQB(I,K,L)-SB**2/TEMP)/(TEMP-1.)                            1490
      IF(SDB.LT..0005) GO TO 970                                        1491
      SDB=SDB**.5                                                       1492
      TMPP=SDA/SDB                                                      1493
      AV(I,K)=SA/TEMP+(AV(ITP,LX)-SB/TEMP)*TP*TMPP                      1494
      SD(I,K)=SDA+(SD(ITP,LX)-SDB)*TP**2*TMPP                           1495
  970 CONTINUE                                                          1496
  980 CONTINUE                                                          1497
  985 IF(ISKEW.GT.0) GO TO 1020                                         1498
      IF(NSMTH.LE.(-1)) GO TO 1050                                      1499
C                     SMOOTH SKEW COEFFICIENT                         1500
      DO 1040 K=1,NSTA                                                  1501
      SA=0.                                                             1502
      SC=0.                                                             1503
      SAA=0.                                                            1504
      SAC=0.                                                            1505
      ITMP=NDUR                                                         1506
      DO 1000 I=1,NDUR                                                  1507
      IF(NLOG(I,K).LT.3) GO TO 990                                      1508
      IF(SKEW(I,K).GT.1.) SKEW(I,K)=1.                                  1509
      IF(SKEW(I,K).LT.(-1.)) SKEW(I,K)=-1.                              1510
      IF(NDUR.LT.3) GO TO 1000                                          1511
      TP=AV(I,K)-ALOG(P(I))                                             1512
      TEMP=SKEW(I,K)                                                    1513
      SA=SA+TP                                                          1514
      SC=SC+TEMP                                                        1515
      SAA=SAA+TP*TP                                                     1516
      SAC=SAC+TP*TEMP                                                   1517
      GO TO 1000                                                        1518
  990 ITMP=ITMP-1                                                       1519
 1000 CONTINUE                                                          1520
      IF(ITMP.LT.3) GO TO 1050                                          1521
      TP=ITMP                                                           1522
      SAA=SAA-SA*SA/TP                                                  1523
      SAC=SAC-SA*SC/TP                                                  1524
      BC=SAC/SAA                                                        1525
      IF(BC.GT.1.) BC=1.                                                1526
      IF(BC.LT.(-1.)) BC=-1.                                            1527
      CC=(SC-BC*SA)/TP                                                  1528
      DO 1010 I=1,NDUR                                                  1529
      TEMP=AV(I,K)-ALOG(P(I))                                           1530
      SKEW(I,K)=CC+BC*TEMP                                              1531
 1010 CONTINUE                                                          1532
 1040 CONTINUE                                                          1533
      GO TO 1050                                                        1534
 1020 DO 1030 I=1,NDUR                                                  1535
      DO 1030 K=1,NSTA                                                  1536
      SKEW(I,K)=SKW(I)                                                  1537
 1030 CONTINUE                                                          15371
 1050 WRITE(6,1060)                                                     1538
 1060 FORMAT(/63H FREQUENCY STATISTICS AFTER ADJUSTMENT WITH A LONG TERM 1539
     1 STATION )                                                        1540
      WRITE(6,490)(AA(I),AB(I),I=1,NDUR)                                1541
      DO 1120 K=1,NSTA                                                  1542
      WRITE(6,1070)ISTA(K),(AV(I,K),I=1,NDUR)                           1543
 1070 FORMAT(/I8,8H    MEAN 10F11.3)                                    1544
      WRITE(6,1080)(SD(I,K),I=1,NDUR)                                   1545
 1080 FORMAT(9X,7HSTD DEV 10F11.3)                                      1546
      WRITE(6,1090)(SKEW(I,K),I=1,NDUR)                                 1547
 1090 FORMAT(12X,4HSKEW 10F11.3)                                        1548
      WRITE(6,1100)(DQ(I,K),I=1,NDUR)                                   1549
 1100 FORMAT(10X,6HINCRMT F10.2,9F11.2)                                 1550
      WRITE(6,2000)(ANYR(I,K),I=1,NDUR)                                 1551
 1110 FORMAT (11X,5HYEARS 10F11.0)                                      1552
      DO 1120 I=1,NDUR                                                  1553
```

```
      ANYR(I,K)=NLOG(I,K)                                                1554
 1120 CONTINUE                                                           1555
                                                                         1556
C  * * * * * * TRANSFORM TO STANDARDIZED VARIATES  * * * * * * * * * * 1557
 1130 DO 1180 K=1,NSTA                                                   1558
      M=0                                                                1559
      DO 1170 J=1,NYRS                                                   1560
      DO 1160 I=1,NDUR                                                   1561
      M=M+1                                                              1562
      IF(Q(M,K).GE.T)GO TO 1160                                          1563
      IF(SD(I,K).LE.0.)GO TO 1150                                        1564
      Q(M,K)=(Q(M,K)-AV(I,K))/SD(I,K)                                    1565
C             PEARSON TYPE III TRANSFORM                                 1566
      TMPP=SKEW(I,K)                                                     1567
      IF(TMPP.EQ.0.) GO TO 1160                                          1568
      TEMP=.5*TMPP*Q(M,K)+1.                                             1569
      TMP=1.                                                             1570
      IF(TEMP.GE.0.)GO TO 1140                                           1571
      TEMP=-TEMP                                                         1572
      TMP=-TMP                                                           1573
 1140 Q(M,K)=6.*(TMP*TEMP**(1./3.)-1.)/TMPP+TMPP/6.                      1574
      GO TO 1160                                                         1575
 1150 Q(M,K)=0.                                                          1576
 1160 CONTINUE                                                           1577
 1170 CONTINUE                                                           1578
 1180 CONTINUE                                                           1579
      ITRNS=-1                                                           1580
      GO TO 740                                                          1581
C  * * * * * * ESTIMATE MISSING CORRELATION COEFFICIENTS * * * * * * * * 1582
 1190 IF(NSTA.LE.1) GO TO 1370                                           1583
      DO 1260 I=1,NDUR                                                   1584
      IX=I-1                                                             1585
      IF(I.EQ.1)IX=I+1                                                   1586
      DO 1250 K=1,NSTA                                                   1587
      KX=K+1                                                             1588
      IF (KX.GT.NSTAX) GO TO 1250                                        1589
      DO 1240 L=KX,NSTAX                                                 1590
C             L AND K CORRELATION POSSIBLY MISSING                       1591
      IF(RA(I,K,L).GE.(-1.))GO TO 1240                                   1592
      RMAX=1.                                                            1593
      RMIN=-1.                                                           1594
C             LX SEARCHES ALL DIRECTLY RELATED CORRELATIONS              1595
      DO 1230 LX=1,NSTAX                                                 1596
      IF(LX.EQ.K)GO TO 1230                                              1597
      IF(LX.EQ.L)GO TO 1230                                              1598
      TEMP=RA(I,K,LX)                                                    1599
      IF(L.LE.NSTA)GO TO 1200                                            1600
      IF(LX.LE.NSTA)GO TO 1210                                           1601
C             BOTH L AND LX REPRESENT ADJACENT DURATIONS                 1602
      ITMP=L-NSTA                                                        1603
      ITEMP=LX-NSTA                                                      1604
      TMP=RA(IX,ITMP,ITEMP)                                              1605
      GO TO 1220                                                         1606
C             L REPRESENTS CURRENT DURATION                              1607
 1200 TMP=RA(I,L,LX)                                                     1608
      GO TO 1220                                                         1609
C             LX AND NOT L REPRESENTS CURRENT DURATION                   1610
 1210 TMP=RA(I,LX,L)                                                     1611
 1220 IF(TMP*TEMP.LT.(-2.))GO TO 1230                                    1612
      TMPA=((1.-TEMP*TEMP)*(1.-TMP*TMP))**.5                             1613
      TMPB=TMP*TEMP+TMPA                                                 1614
      IF(TMPB.LT.RMAX)RMAX=TMPB                                          1615
      TMPB=TMPB-TMPA-TMPA                                                1616
      IF(TMPB.GT.RMIN)RMIN=TMPB                                          1617
 1230 CONTINUE                                                           1618
C             AVERAGE SMALLEST MAX AND LARGEST MIN CONSISTENT VALUE      1619
      RA(I,K,L)=(RMAX+RMIN)*.5                                           1620
      IF (RA(I,K,L).LT.0.0) RA(I,K,L)=0.                                 1621
      IF(L.LE.NSTA)RA(I,L,K)=RA(I,K,L)                                   1622
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EXHIBIT 6

```
 1240 CONTINUE                                                          1623
 1250 CONTINUE                                                          1624
 1260 CONTINUE                                                          1625
      GO TO 1370                                                        1626
C  * * * * * * PRINT CORRELATION MATRIX  * * * * * * * * * * * * * * * 1627
 1270 DO 1360 I = 1,NDUR                                                1628
      IF(ITRNS.LT.1) WRITE(6,1280)AA(I),AB(I)                           1629
 1280 FORMAT(//46H CORRELATION COEFFICIENTS OF RECORDED DATA FOR 2A4,9H  1630
     1DURATION )                                                        1631
      IF(ITRNS.GT.0) WRITE(6,1290)AA(I),AB(I)                           1632
 1290 FORMAT(//64H CORRELATION COEFFICIENTS OF RECORDED AND RECONSTITUTE 1633
     1D DATA FOR 2A4,9H DURATION)                                       1634
      WRITE(6,1300)(ISTA(K),K=1,NSTA)                                   1635
 1300 FORMAT(/3X,3HSTA 20I6)                                            1636
      WRITE(6,1310)                                                     1637
 1310 FORMAT(20X,18HWITH SAME DURATION)                                 1638
      DO 1320 K=1,NSTA                                                  1639
      WRITE(6,1330)ISTA(K),(RA(I,K,L),L=1,NSTA)                         1640
 1320 CONTINUE                                                          1641
 1330 FORMAT(1X,I5,20F6.3)                                              1642
      IF (NDUR.EQ.1) GO TO 1360                                         1643
      WRITE(6,1340)                                                     1644
 1340 FORMAT(20X,39HWITH ADJACENT DURATION AT ABOVE STATION)            1645
      ITP=NSTA+1                                                        1646
      DO 1350 K=1,NSTA                                                  1647
      WRITE(6,1330)ISTA(K),(RA(I,K,L),L=ITP,NSTAX)                      1648
 1350 CONTINUE                                                          1649
 1360 CONTINUE                                                          1650
      IF(KRCRD.EQ.1) GO TO 1760                                         1651
      IF(ITRNS) 1190,1190,2020                                          1652
C  * * * * * * RECONSTITUTE MISSING DATA * * * * * * * * * * * * * * * 1653
 1370 M=0                                                               1654
      NVAR=NSTA+1                                                       1655
      DO 1750 J=1,NYRS                                                  1656
      IF (IRCRD(J).EQ.1) GO TO 1380                                     1657
      M=M+NDUR                                                          1658
      GO TO 1750                                                        1659
 1380 DO 1740 I=1,NDUR                                                  1660
      MM=M                                                              1661
      MX=M                                                              1662
      M=M+1                                                             1663
      IF(J.EQ.1)MM=M+1                                                  1664
      DO 1730 K=1,NSTA                                                  1665
      KX=NSTA+K                                                         1666
      IF (Q(M,K).LT.T.OR.NLOG(I,K).LT.3) GO TO 1730                     1667
      NINDP=0                                                           1668
      IPREV=0                                                           1669
C               FORM CORRELATION MATRIX FOR EACH MISSING FLOW           1670
      DO 1450 L=1,NSTA                                                  1671
      LA = NINDP                                                        1672
      IF(L.EQ.K)GO TO 1420                                              1673
      IF(Q(M,L).GE.T)GO TO 1450                                         1674
      NINDP=NINDP+1                                                     1675
      X(NINDP)=Q(M,L)                                                   1676
      DO 1410 LX = L,NSTA                                               1677
      IF(LX.EQ.K)GO TO 1390                                             1678
      IF(Q(M,LX).GE.T)GO TO 1410                                        1679
      LA=LA+1                                                           1680
      R(NINDP,LA)=RA(I,L,LX)                                            1681
      GO TO 1400                                                        1682
 1390 IF (NDUR.EQ.1) GO TO 1410                                         1683
      IF(Q(MM,LX).GE.T)GO TO 1410                                       1684
      LA=LA+1                                                           1685
      R(NINDP,LA) = RA(I,L,KX)                                          1686
 1400 R(LA,NINDP) = R(NINDP,LA)                                         1687
 1410 CONTINUE                                                          1688
      R(NINDP,NVAR)=RA(I,L,K)                                           1689
      GO TO 1450                                                        1690
 1420 IF (NDUR.EQ.1) GO TO 1450                                         1691
      IF(Q(MM,K).GE.T)GO TO 1450                                        1692
```

```
      NINDP=NINDP+1                                                          1693
      IPREV=NINDP                                                            1694
      X(NINDP)=Q(MM,L)                                                       1695
      DO 1440 LX = L,NSTA                                                    1696
      IF(LX.EQ.K)GO TO 1430                                                  1697
      IF(Q(M,LX).GE.T)GO TO 1440                                             1698
      LA=LA+1                                                                1699
      R(NINDP,LA) = RA(I,LX,KX)                                              1700
      R(LA,NINDP)=R(NINDP,LA)                                                1701
      GO TO 1440                                                             1702
 1430 LA=LA+1                                                                1703
      R(NINDP,LA)=1.                                                         1704
 1440 CONTINUE                                                               1705
      R(NINDP,NVAR)=RA(I,L,KX)                                               1706
 1450 CONTINUE                                                               1707
C             CASE NUMBER 1 RESULTS WHEN NO FLOWS ARE FOUND FOR CORRELA      1708
      ICSE=1                                                                 1709
      IF(NINDP.LE.0) GO TO 1510                                              1710
      ITMP=NINDP+1                                                           1711
      DO 1460 IX=1,NINDP                                                     1712
 1460 R(IX,ITMP)=R(IX,NVAR)                                                  1713
C     ==========                                                             1714
 1470 CALL CROUT(R)                                                          1715
C     ==========                                                             1716
      ITEMP=NINDP+1                                                          1717
      TEMP=1.                                                                1718
      INDC=0                                                                 1719
      DO 1490 L=1,NINDP                                                      1720
      TMP=ABS(R(L,ITEMP))                                                    1721
      IF(TMP.GT.TEMP) GO TO 1480                                             1722
      IF(L.EQ.IPREV.AND.TMP.GE..9) GO TO 1480                                1723
      TEMP=TMP                                                               1724
      ITP=L                                                                  1725
 1480 IF(R(L,ITEMP).LT.0..AND.B(L).GT.(-1.5).AND.B(L).LT..5) GO TO 1490      1726
      IF(R(L,ITEMP).GT.0..AND.B(L).GT.(-.5).AND.B(L).LT.1.5) GO TO 1490      1727
      INDC=1                                                                 1728
 1490 CONTINUE                                                               1729
      IF(INDC.GT.0) GO TO 1500                                               1730
      IF(DTRMC.LE.1..AND.DTRMC.GE.0.) GO TO 1590                             1731
C             IF MATRIX INCONSISTENT, OMIT VARIABLE WITH LEAST CORRELAT      1732
 1500 ITMP=NINDP-1                                                           1733
      IF(ITMP.GT.0) GO TO 1530                                               1734
C             CASE NUMBER 2 RESULTS WHEN ALL CORRELATIONS ARE ZERO           1735
      ICSE=2                                                                 1736
C             POSSIBLE BRANCH FROM 870+2                                     1737
 1510 IYR=IYRA+J                                                             1738
      WRITE(6,1520) ISTA(K),I,IYR,ICSE                                       1739
 1520 FORMAT(/25H ZERO CORRELATION FOR STA ,I6,10H  DURATION ,I2,6H  YEA      1740
     1R ,I5,6H  CASE ,I2/)                                                   1741
      B(1)=0.                                                                1742
      X(1)=0.                                                                1743
      DTRMC=0.                                                               1744
      GO TO 1590                                                             1745
 1530 IF(ITP.GT.ITMP) GO TO 1560                                             1746
      DO 1550 L=ITP,ITMP                                                     1747
      DO 1540 LA=1,ITEMP                                                     1748
 1540 R(L,LA)=R(L+1,LA)                                                      1749
 1550 X(L)=X(L+1)                                                            1750
 1560 DO 1580 L=1,ITMP                                                       1751
      DO 1570 LA=ITP,NINDP                                                   1752
 1570 R(L,LA)=R(L,LA+1)                                                      1753
 1580 CONTINUE                                                               1754
      NINDP=ITMP                                                             1755
      GO TO 1470                                                             1756
C             ADD RANDOM COMPONENT TO PRESERVE VARIANCE                      1757
 1590 TMP=RNGEN(IXX)                                                         1758
      TEMP=RNGEN(IXX)                                                        1759
      TEMP=(-2.*ALOG(TEMP))**.5*SIN(6.2832*TMP)                              1760
C             COMPUTE FLOW                                                   1761
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EXHIBIT 6

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      TEMP=TEMP*(1.-DTRMC)**.5                                          1762
      DO 1600 L=1,NINDP                                                 1763
      TEMP=TEMP+B(L)*X(L)                                               1764
 1600 CONTINUE                                                          1765
      Q(M,K)=TEMP                                                       1766
      ANYR(I,K)=ANYR(I,K)+DTRMC                                         1767
      TP=Q(M,K)                                                         1768
C               ADD NEW VALUE TO SUMS OF SQUARES AND CROSS PRODUCTS     1769
      DO 1670 L=1,NSTAX                                                 1770
C               SUBSCRIPTS EXCEEDING NSTA RELATE TO PRECEDING MONTH     1771
 1610 IF(L.LE.NSTA) GO TO 1620                                          1772
      LX=L-NSTA                                                         1773
      IF (I.EQ.1) TMP=Q(M+1,LX)                                         1774
      IF(I.GT.1) TMP=Q(M-1,LX)                                          1775
      GO TO 1630                                                        1776
 1620 TMP=Q(M,L)                                                        1777
 1630 IF(TMP.GE.T) GO TO 1670                                           1778
C               COUNT AND USE ONLY RECORDED PAIRS                       1779
      NCAB(I,K,L)=NCAB(I,K,L)+1                                         1780
      SUMA(I,K,L)=SUMA(I,K,L)+TP                                        1781
      SUMB(I,K,L)=SUMB(I,K,L)+TMP                                       1782
      SQA (I,K,L)=SQA (I,K,L)+TP*TP                                     1783
      SQB (I,K,L)=SQB (I,K,L)+TMP*TMP                                   1784
      XPAB(I,K,L)=XPAB(I,K,L)+TP*TMP                                    1785
      IF(L.GT.NSTA) GO TO 1640                                          1786
      NCAB(I,L,K)=NCAB(I,K,L)                                           1787
      SUMA(I,L,K)=SUMB(I,K,L)                                           1788
      SUMB(I,L,K)=SUMA(I,K,L)                                           1789
      SQA (I,L,K)=SQB (I,K,L)                                           1790
      SQB (I,L,K)=SQA (I,K,L)                                           1791
      XPAB(I,L,K)=XPAB(I,K,L)                                           1792
C               RECOMPUTE CORRELATION COEFFICIENTS TO INCLUDE NEW DATA  1793
C               ELIMINATE PAIRS WITH LESS THAN 3 YRS DATA               1794
 1640 IF(NCAB(I,K,L).LE.2) GO TO 1670                                   1795
      TEMP=NCAB(I,K,L)                                                  1796
      TMP=(SQA(I,K,L)-SUMA(I,K,L)*SUMA(I,K,L)/TEMP)*(SQB(I,K,L)-SUMB    1797
     1(I,K,L)*SUMB(I,K,L)/TEMP)                                         1798
C               ELIMINATE PAIRS WITH ZERO VARIANCE PRODUCT              1799
      IF(TMP.LE.0.) GO TO 1670                                          1800
      TMPB=1.                                                           1801
      TMPA=XPAB(I,K,L)-SUMA(I,K,L)*SUMB(I,K,L)/TEMP                     1802
C               RETAIN ALGEBRAIC SIGN                                   1803
      IF(TMPA.LT.0.)TMPB=-TMPB                                          1804
      TMPA=TMPA*TMPA/TMP                                                1805
      RA(I,K,L)=TMPB*TMPA**.5                                           1806
      IF(RA(I,K,L).GE.0.) GO TO 1660                                    1807
 1650 RA(I,K,L)=0.                                                      1808
 1660 IF(L.GT.NSTA) GO TO 1670                                          1809
      RA(I,L,K)=RA(I,K,L)                                               1810
 1670 CONTINUE                                                          1811
      IF(NDUR.EQ.1)GO TO 1730                                           1812
      DO 1720 L=1,NSTA                                                  1813
      ITP=0                                                             1814
      IX=I+1                                                            1815
      IF(IX.GT.NDUR) GO TO 1680                                         1816
      TMP=Q(M+1,L)                                                      1817
      GO TO 1700                                                        1818
 1680 IF(I.GT.2) GO TO 1730                                             1819
 1690 TMP=Q(M-1,L)                                                      1820
      IX=I-1                                                            1821
      ITP=1                                                             1822
 1700 IF(TMP.GE.T) GO TO 1720                                           1823
      NCAB(IX,L,KX)=NCAB(IX,L,KX)+1                                     1824
      SUMA(IX,L,KX)=SUMA(IX,L,KX)+TMP                                   1825
      SUMB(IX,L,KX)=SUMB(IX,L,KX)+TP                                    1826
      SQA (IX,L,KX)=SQA (IX,L,KX)+TMP**2                                1827
      SQB (IX,L,KX)=SQB (IX,L,KX)+TP**2                                 1828
      XPAB(IX,L,KX)=XPAB(IX,L,KX)+TMP*TP                                1829
      IF(NCAB(IX,L,KX).LE.2) GO TO 1720                                 1830
      TEMP=NCAB(IX,L,KX)                                                1831
```


EXHIBIT 6

```
      TMP=(SQA(IX,L,KX)-SUMA(IX,L,KX)**2/TEMP)*(SQB(IX,L,KX)-          1832
     1SUMB(IX,L,KX)**2/TEMP)                                           1833
      IF(TMP.LE.0.) GO TO 1710                                         1834
      TMPB=1.                                                          1835
      TMPA=XPAB(IX,L,KX)-SUMA(IX,L,KX)*SUMB(IX,L,KX)/TEMP              1836
      IF(TMPA.LT.0.) TMPB=-TMPB                                        1837
      TMPA=TMPA**2/TMP                                                 1838
      RA(IX,L,KX)=TMPB*TMPA**.5                                        1839
      IF(RA(IX,L,KX).GE.0.) GO TO 1720                                 1840
 1710 RA(IX,L,KX)=0.                                                   1841
      IF(I.EQ.2.AND.ITP.LT.1) GO TO 1690                               1842
 1720 CONTINUE                                                         1843
 1730 CONTINUE                                                         1844
 1740 CONTINUE                                                         1845
 1750 CONTINUE                                                         1846
 1760 WRITE(6,50)                                                      1847
      WRITE(6,1770)                                                    1848
 1770 FORMAT(33H RECORDED AND RECONSTITUTED DATA )                     1849
      DO 1980 K=1,NSTA                                                 1850
      IF(K.GE.NSTXX) WRITE(6,1780)(AA(I),AB(I),I=1,NDUR)               1851
 1780 FORMAT(/2X,10H STA  YEAR 4X,A3,A4,9(3X,2A4))                     1852
      M=0                                                              1853
C               CONVERT STANDARD DEVIATES TO FLOWS                     1854
      ANYRS=NYRS                                                       1855
      DO 1890 J=1,NYRS                                                 1856
      IF (IRCRD(J).EQ.1) GO TO 1790                                    1857
      M=M+NDUR                                                         1858
      ANYRS=ANYRS-1.                                                   1859
      GO TO 1890                                                       1860
 1790 DO 1870 I=1,NDUR                                                 1861
      M=M+1                                                            1862
      X(I)=QR(M,K)                                                     1863
      XQ(I)=Q(M,K)                                                     1864
      IF(ICORL.EQ.0)GO TO 1870                                         1865
      IF (NLOG(I,K).LT.3) GO TO 1860                                   1866
      TEMP=Q(M,K)                                                      1867
      TMP=SKEW(I,K)                                                    1868
C               USE ADOPTED SKEW FOR RECONSTITUTING                    1869
      IF(ISKEW.GT.0) TMP=SKW(I)                                        1870
      IF(TMP.EQ.0.) GO TO 1820                                         1871
      TEMP=((TMP*(TEMP-TMP/6.)/6.+1.)**3-1.)*2./TMP                    1872
      IF(QR(M,K).NE.E) GO TO 1820                                      1873
      TMPP=(-2.)/TMP                                                   1874
      IF(TMP) 1800,1820,1810                                           1875
 1800 IF(TEMP.GT.TMPP) TEMP=TMPP                                       1876
      GO TO 1820                                                       1877
 1810 IF(TEMP.LT.TMPP) TEMP=TMPP                                       1878
 1820 TMP=TEMP*SD(I,K)+AV(I,K)                                         1879
      TEMP=10.**TMP-DQ(I,K)                                            1880
      IF(TEMP.LT.0.) TEMP=0.                                           1881
      IF(TEMP.LT.QMIN(I,K)) QMIN(I,K)=TEMP                             1882
      Q(M,K)=TEMP                                                      1883
      IF(I.EQ.1) GO TO 1850                                            1884
      TMP=Q(M-1,K)*P(I)/P(I-1)                                         1885
      IF(Q(M,K).LT.TMP) GO TO 1850                                     1886
      IF(QR(M,K).EQ.E) GO TO 1840                                      1887
      ITP=I-1                                                          1888
      DO 1830 L=1,ITP                                                  1889
      TMP=Q(M-L,K)*P(I)/P(I-L)                                         1890
      IF(TMP.LT.Q(M,K).AND.QR(M-L,K).EQ.E)Q(M-L,K)=Q(M,K)*P(I-L)/P(I)  1891
      IF(NLOG(I-L,K).GT.2) XQ(I-L)=Q(M-L,K)                            1892
 1830 CONTINUE                                                         1893
      GO TO 1850                                                       1894
 1840 Q(M,K)=TMP                                                       1895
 1850 XQ(I)=Q(M,K)                                                     1896
      GO TO 1870                                                       1897
 1860 XQ(I)=-1.                                                        1898
 1870 CONTINUE                                                         1899
      IF(K.LT.NSTXX) GO TO 1890                                        1900
      IYR=IYRA+J                                                       1901
```


EXHIBIT 6

```
      WRITE(6,1880) ISTA(K),IYR,(XQ(I),X(I),I=1,NDUR)                    1902
 1880 FORMAT(2I6,F11.0,A1,F10.0,A1,8(F10.0,A1))                          1903
      IF(IPCHQ.GT.0) WRITE(7,60) ISTA(K),IYR,(XQ(I),I=1,NDUR)            1904
 1890 CONTINUE                                                           1905
      IF(K.LT.NSTXX) GO TO 1980                                          1906
      IF(ICORL.EQ.0.OR.KRCRD.GE.1) GO TO 1980                            1907
      INDC=0                                                             1908
 1900 DO 1910 I=1,NDUR                                                   1909
      IF(QMIN(I,K)+DQ(I,K).GT..0001) GO TO 1910                          1910
      INDC=1                                                             1911
 1910 CONTINUE                                                           1912
      IF(INDC.LT.1) GO TO 1930                                           1913
      DO 1920 I=1,NDUR                                                   1914
      DQ(I,K)=DQ(I,K)+XINCR(I,K)                                         1915
 1920 CONTINUE                                                           1916
      GO TO 1900                                                         1917
C  * * * * * * RECOMPUTE FREQUENCY STATISTICS  * * * * * * * * * * * * * 1918
 1930 DO 1970 I=1,NDUR                                                   1919
      IF (NLOG(I,K).LT.3) GO TO 1960                                     1920
      TMP=0.                                                             1921
      TEMP=0.                                                            1922
      TMPA=0.                                                            1923
      M=I                                                                1924
      DO 1950 J=1,NYRS                                                   1925
      IF (IRCRD(J).EQ.0) GO TO 1940                                      1926
      TP=ALOG(Q(M,K)+DQ(I,K))                                            1927
      TMP=TMP+TP                                                         1928
      TEMP=TEMP+TP*TP                                                    1929
      TMPA=TMPA+TP*TP*TP                                                 1930
 1940 M = M + NDUR                                                       1931
 1950 CONTINUE                                                           1932
      AV(I,K)=TMP*.4342945/ANYRS                                         1933
      SD(I,K)=((TEMP-TMP*TMP/ANYRS)/(ANYRS-1.))**.5                      1934
      SKEW(I,K)=(ANYRS*ANYRS*TMPA-3.*ANYRS*TMP*TEMP+2.*TMP**3)/          1935
     1  (ANYRS*(ANYRS-1.)*(ANYRS-2.)*SD(I,K)**3)                         1936
                                                                         1937
      SD(I,K)=SD(I,K)*.4342945                                           1938
      GO TO 1970                                                         1939
 1960 ANYR(I,K)=0.                                                       1940
 1970 CONTINUE                                                           1941
 1980 CONTINUE                                                           1942
      IF(ICORL.EQ.0.OR.KRCRD.GE.1) GO TO 2020                            1943
      WRITE(6,50)                                                        1944
      WRITE(6,1990)                                                      1945
 1990 FORMAT(//56H FREQUENCY STATISTICS OF RECORDED AND RECONSTITUTED DA 1946
     1TA )                                                               1947
      WRITE(6,490)(AA(I),AB(I),I=1,NDUR)                                 1948
      DO 2010 K=NSTXX,NSTA                                               1949
      WRITE(6,1070)ISTA(K),(AV(I,K),I=1,NDUR)                            1950
      WRITE(6,1080)(SD(I,K),I=1,NDUR)                                    1951
      WRITE(6,1090) (SKEW(I,K),I=1,NDUR)                                 1952
      WRITE (6,2000) (ANYR(I,K),I=1,NDUR)                                1953
 2000 FORMAT (7X,9HEQUIV YRS 10F11.1)                                    1954
 2010 CONTINUE                                                           1955
C                RECOMPUTE CORRELATION MATRIX                           1956
      ITRNS=1                                                            1957
      GO TO 730                                                          1958
C  * * * * * * ARRANGE FLOWS IN ORDER  * * * * * * * * * * * * * * * * * 1959
 2020 ITMP=ANYRS+.1                                                      1960
C                COMPUTE MEDIAN PLOTTING POSITIONS                      1961
      TEMP=1./ANYRS                                                      1962
      PLTT(1)=(1.-.5**TEMP)*100.                                         1963
      TEMP=(100.-PLTT(1)-PLTT(1))/(ANYRS-1.)                             1964
      DO 2030 J=2,ITMP                                                   1965
      PLTT(J)=PLTT(J-1)+TEMP                                             1966
 2030 CONTINUE                                                           1967
      WRITE(6,2040)                                                      1968
 2040 FORMAT(//17H FREQUENCY ARRAYS)                                     1969
      DO 2130 K=NSTXX,NSTA                                               1970
      DO 2080 I=1,NDUR                                                   1971
```

```
      M=I                                                                1972
      QM(I)=Q(M,K)                                                       1973
      IF(QM(I).GE.T) QM(I)=-T                                            1974
      X(I)=QR(M,K)                                                       1975
      JA=1                                                               1976
      DO 2070 J=2,NYRS                                                   1977
      M=M+NDUR                                                           1978
      IF (IRCRD(J)[illegible] TO 2070                                    1979
      JA=JA+1                                                            1980
      TEMP=Q(M,K)                                                        1981
      JX=JA*NDUR+I                                                       1982
      DO 2050 L=2,JA                                                     1983
      LX=JX-L*NDUR                                                       1984
      ITP=LX+NDUR                                                        1985
      IF(QM(LX).GE.TEMP)GO TO 2060                                       1986
      QM(ITP)=QM(LX)                                                     1987
      X(ITP)=X(LX)                                                       1988
 2050 CONTINUE                                                           1989
      QM(I)=TEMP                                                         1990
      X(I)=QR(M,K)                                                       1991
      GO TO 2070                                                         1992
 2060 QM(ITP)=TEMP                                                       1993
      X(ITP)=QR(M,K)                                                     1994
 2070 CONTINUE                                                           1995
 2080 CONTINUE                                                           1996
      WRITE(6,2410)ISTA(K)                                               1997
 2090 FORMAT(/10H NO  PLOT 3X,A3,A4,9(3X,2A4))                           1998
      WRITE(6,2090)(AA(I),AB(I),I=1,NDUR)                                1999
      M=0                                                                2000
      DO 2120 J=1,ITMP                                                   2001
      DO 2100 I=1,NDUR                                                   2002
      M=M+1                                                              2003
      X(I)=X(M)                                                          2004
      XQ(I)=QM(M)                                                        2005
      IF(NLOG(I,K).LT.3) XQ(I)=-1.                                       2006
 2100 CONTINUE                                                           2007
      WRITE(6,2110)J,PLTT(J),(XQ(I),X(I),I=1,NDUR)                       2008
 2110 FORMAT(1X,I3,F6.2,F11.0,A1,9(F10.0,A1))                            2009
 2120 CONTINUE                                                           2010
 2130 CONTINUE                                                           2011
      GO TO 2190                                                         2012
C  * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * 2013
C               READ STATISTICS, IF SUPPLIED                             2014
 2140 WRITE(6,2150)                                                      2015
 2150 FORMAT(/27H INPUT FREQUENCY STATISTICS )                           2016
      WRITE(6,490) (AA(I),AB(I),I=1,NDUR)                                2017
      DO 2180 K=1,NSTA                                                   2018
      DO 2170 I=1,NDUR                                                   2019
C                                                  ** CARD I **          2020
      READ(5,2160) ISTA(K),AV(I,K),SD(I,K),SKEW(I,K),DQ(I,K),ANYR(I,K)   2021
 2160 FORMAT(1X,I7,8X,5F8.0)                                             2022
      NLOG(I,K)=ANYR(I,K)                                                2023
 2170 CONTINUE                                                           2024
      WRITE(6,1070)ISTA(K),(AV(I,K),I=1,NDUR)                            2025
      WRITE(6,1080)(SD(I,K),I=1,NDUR)                                    2026
      WRITE(6,1090)(SKEW(I,K),I=1,NDUR)                                  2027
      WRITE(6,1100) (DQ(I,K),I=1,NDUR)                                   2028
      WRITE(6,2000) (ANYR(I,K),I=1,NDUR)                                 2029
 2180 CONTINUE                                                           2030
 2190 DO 2250 K=NSTXX,NSTA                                               2031
C  * * * * * * SMOOTH STATISTICS * * * * * * * * * * * * * * * * * * * * 2032
      IF (NSMTH.LE.(-1)) GO TO 2230                                      2033
      IF(NDUR.LT.3)GO TO 2230                                            2034
C               SUMS, SQUARES AND CROSS PRODUCTS                         2035
      SA=0.                                                              2036
      SB=0.                                                              2037
      SC=0.                                                              2038
      SAA=0.                                                             2039
      SAB=0.                                                             2040
      SAC=0.                                                             2041
      ITMP=NDUR                                                          2042
```


EXHIBIT 6

```
      DO 2210 I=1,NDUR                                                  2043
      IF (NLOG(I,K).LT.3) GO TO 2200                                    2044
      TP=AV(I,K)-ALOG(P(I))                                             2045
      TMP=SD(I,K)                                                       2046
      IF(SKEW(I,K).GT.1.) SKEW(I,K)=1.                                  2047
      IF(SKEW(I,K).LT.(-1.)) SKEW(I,K)=(-1.)                            2048
      TEMP=SKEW(I,K)                                                    2049
      SA=SA+TP                                                          2050
      SB=SB+TMP                                                         2051
      SC=SC+TEMP                                                        2052
      SAA=SAA+TP*TP                                                     2053
      SAB=SAB+TP*TMP                                                    2054
      SAC=SAC+TP*TEMP                                                   2055
      GO TO 2210                                                        2056
 2200 ITMP=ITMP-1                                                       2057
 2210 CONTINUE                                                          2058
      IF (ITMP.LT.3) GO TO 2230                                         2059
C               LINEAR REGRESSION, STD DEV AND SKEW VS MEAN             2060
      TP=ITMP                                                           2061
      SAA=SAA-SA*SA/TP                                                  2062
      SAB=SAB-SA*SB/TP                                                  2063
      SAC=SAC-SA*SC/TP                                                  2064
C               LIMIT REGRESSION COEFFICIENT FOR CONSISTENCY            2065
      BB=SAB/SAA                                                        2066
      IF(BB.GT..25)BB=.25                                               2067
      IF(BB.LT.(-.25))BB=-.25                                           2068
      BC=SAC/SAA                                                        2069
      IF(BC.GT.1.)BC=1.                                                 2070
      IF(BC.LT.(-1.))BC=-1.                                             2071
C               REGRESSION CONSTANTS                                    2072
      SA=SA/TP                                                          2073
      SB=SB/TP                                                          2074
      CB=SB-BB*SA                                                       2075
      SC=SC/TP                                                          2076
      CC=SC-BC*SA                                                       2077
C               COMPUTE SMOOTHED STATISTICS                             2078
      DO 2220 I=1,NDUR                                                  2079
      IF (NLOG(I,K).LT.3) GO TO 2220                                    2080
      TEMP=AV(I,K)-ALOG(P(I))                                           2081
      SD(I,K)=CB+BB*TEMP                                                2082
      IF (SD(I,K).LT.0.) SD(I,K)=0.                                     2083
      SKEW(I,K)=CC+BC*TEMP                                              2084
 2220 CONTINUE                                                          2085
 2230 IF (ISKEW.LE.0) GO TO 2250                                        2086
      DO 2240 I=1,NDUR                                                  2087
      SKEW(I,K)=SKW(I)                                                  2088
 2240 CONTINUE                                                          2089
 2250 CONTINUE                                                          2090
      IF (NDUR.LT.3.AND.ISKEW.LE.0) GO TO 2290                          2091
      WRITE(6,50)                                                       2092
      WRITE(6,2260)                                                     2093
 2260 FORMAT(//29H ADOPTED FREQUENCY STATISTICS)                        2094
      WRITE(6,490)(AA(I),AB(I),I=1,NDUR)                                2095
      DO 2280 K=NSTXX,NSTA                                              2096
      WRITE(6,1070)ISTA(K),(AV(I,K),I=1,NDUR)                           2097
      WRITE(6,1080)(SD(I,K),I=1,NDUR)                                   2098
      WRITE(6,1090)(SKEW(I,K),I=1,NDUR)                                 2099
      WRITE(6,1100) (DQ(I,K),I=1,NDUR)                                  2100
      IF(IPCHS.GT.0)WRITE(7,2270)(ISTA(K),AA(I),AB(I),AV(I,K),SD(I,K),SK 2101
     1EW(I,K),DQ(I,K),ANYR(I,K),I=1,NDUR)                               2102
 2270 FORMAT(I8,1X,A3,A4,3F8.3,2F8.2/ (I8,2A4,3F8.3,2F8.2 ))            2103
 2280 CONTINUE                                                          2104
                                                                        2105
C  * * * * * * COMPUTE FREQUENCY CURVES  * * * * * * * * * * * * * * * 2106
 2290 TMPA=100.                                                         2107
      X(1)=3.73                                                         2108
      X(2)=3.09                                                         2109
      X(3)=2.33                                                         2110
      X(4)=1.64                                                         2111
      X(5)=1.28                                                         2112
```


EXHIBIT 6

```
      X(6)=.52                                                          2113
      WRITE(6,50)                                                       2114
      WRITE(6,2300)                                                     2115
 2300 FORMAT(26H COMPUTED FREQUENCY CURVES)                             2116
      DO 2400 K=NSTXX,NSTA                                              2117
      TMPB=0.                                                           2118
      TMPP=0.                                                           2119
      DO 2400 II=1,NDUR                                                 2120
      I=NDUR-II+1                                                       2121
      IF(NLOG(I,K).LT.3) GO TO 2310                                     2122
      TMPP=TMPP+1.                                                      2123
      TP=SKEW(I,K)                                                      2124
      TMPB=TMPB+ANYR(I,K)                                               2125
 2310 DO 2390 J=1,13                                                    2126
      IF (NLOG(I,K).LT.3.AND.NSTAT.LT.1) GO TO 2380                     2127
      TEMP=0.                                                           2128
      IF(J-7)2320,2340,2330                                             2129
 2320 TEMP=X(J)                                                         2130
      GO TO 2340                                                        2131
 2330 TEMP=-X(14-J)                                                     2132
C               PEARSON TYPE III TRANSFORM                             2133
 2340 IF(TP.EQ.0.) GO TO 2370                                           2134
      TEMP=2./TP*((TP/6.*(TEMP-TP/6.)+1.)**3-1.)                        2135
      TMP=(-2.)/TP                                                      2136
      IF(TP)         2350,2370,2360                                     2137
 2350 IF(TEMP.GT.TMP) TEMP=TMP                                          2138
      GO TO 2370                                                        2139
 2360 IF(TEMP.LT.TMP)   TEMP=TMP                                        2140
 2370 TMP=AV(I,K)+TEMP*SD(I,K)                                          2141
      QR(J,I)=10.**TMP-DQ(I,K)                                          2142
      IF(QR(J,I).LT.0.) QR(J,I)=0.                                      2143
      IF(II.EQ.1.OR.J.LE.8) GO TO 2390                                  2144
      TMP=QR(J,I+1)*P(I)/P(I+1)                                         2145
      IF(QR(J,I).LT.TMP)QR(J,I)=TMP                                     2146
      GO TO 2390                                                        2147
 2380 QR(J,I)=-1.                                                       2148
 2390 CONTINUE                                                          2149
 2400 CONTINUE                                                          2150
      IF(TMPP.LE.0.) GO TO 2450                                         2151
      PLTT(1)=.01                                                       2152
      PLTT(2)=.1                                                        2153
      PLTT(3)=1.                                                        2154
      PLTT(4)=5.                                                        2155
      PLTT(5)=10.                                                       2156
      PLTT(6)=30.                                                       2157
      PLTT(7)=50.                                                       2158
      PLTT(8)=TMPA-PLTT(6)                                              2159
      PLTT(9)=TMPA-PLTT(5)                                              2160
      PLTT(10)=TMPA-PLTT(4)                                             2161
      PLTT(11)=TMPA-PLTT(3)                                             2162
      PLTT(12)=TMPA-PLTT(2)                                             2163
      PLTT(13)=TMPA-PLTT(1)                                             2164
C               PLOT VALUES EXCEEDING 13 ARE EXPECTED PROBABILITY      2165
      TMP=TMPB/TMPP                                                     2166
      PLTT(14)=.01*(1.+1600./TMP**1.72)                                 2167
      PLTT(15)= .1*(1.+280./TMP**1.55)                                  2168
      PLTT(16)= 1.*(1.+26./TMP**1.16)                                   2169
      PLTT(17)= 5.*(1.+6./TMP**1.04)                                    2170
      PLTT(18)=10.*(1.+3./TMP**1.04)                                    2171
      PLTT(19)=30.*(1.+.46/TMP**.925)                                   2172
      PLTT(20)=50.                                                      2173
      PLTT(21)=TMPA-PLTT(19)                                            2174
      PLTT(22)=TMPA-PLTT(18)                                            2175
      PLTT(23)=TMPA-PLTT(17)                                            2176
      PLTT(24)=TMPA-PLTT(16)                                            2177
      PLTT(25)=TMPA-PLTT(15)                                            2178
      PLTT(26)=TMPA-PLTT(14)                                            2179
      WRITE(6,2410)ISTA(K)                                              2180
 2410 FORMAT(/8H STATION I8)                                            2181
      WRITE(6,2420)(AA(I),AB(I),I=1,NDUR)                               2182
```

```
 2420 FORMAT(4X,16H  PLOT  EXP PROB 4X,A3,A4,9(3X,2A4))                    2183
      DO 2440 J=1,13                                                      2184
      WRITE(6,2430) PLTT(J),PLTT(J+13),(QR(J,I),I=1,NDUR)                 2185
 2430 FORMAT(2F10.2,9F11.0)                                               2186
 2440 CONTINUE                                                            2187
 2450 CONTINUE                                                            2188
      NSTAT=NSTAT-NSTA                                                    2189
      NSTA=NSTAT                                                          2190
      IF(NSTAT.GT.10) NSTA=10                                             2191
      IF(NSTA.GT.0) GO TO 2140                                            2192
      GO TO 100                                                           2193
      END                                                                 2194
      SUBROUTINE CROUT(RX)                                                2195
      DIMENSION B(10),R(10,11),RX(10,11)                                  2196
      COMMON DTRMC,NINDP,B                                                2197
      NVAR=NINDP+1                                                        2198
      DO 20 J=1,NINDP                                                     2199
      DO 10 K=1,NVAR                                                      2200
   10 R(J,K)=RX(J,K)                                                      2201
   20 CONTINUE                                                            2202
      IF(NINDP.GT.1)GO TO 30                                              2203
      B(1)=R(1,2)/R(1,1)                                                  2204
      DTRMC=B(1)*B(1)                                                     2205
      RETURN                                                              2206
C  * * * * * * DERIVED MATRIX  * * * * * * * * * * * * * * * * * * * * * 2207
   30 DO 40 K=2,NVAR                                                      2208
   40 R(1,K)=R(1,K)/R(1,1)                                                2209
      DO 80 K=2,NINDP                                                     2210
      ITP=K-1                                                             2211
      DO 60 J=K,NINDP                                                     2212
      DO 50 I=1,ITP                                                       2213
      L=K-I                                                               2214
   50 R(J,K)=R(J,K)-R(J,L)*R(L,K)                                         2215
      IF(J.EQ.K) GO TO 60                                                 2216
      R(K,J)=R(J,K)/R(K,K)                                                2217
   60 CONTINUE                                                            2218
      DO 70 I=1,ITP                                                       2219
      L=K-I                                                               2220
   70 R(K,NVAR)=R(K,NVAR)-R(L,NVAR)*R(K,L)                                2221
   80 R(K,NVAR)=R(K,NVAR)/R(K,K)                                          2222
C  * * * * * * BACK SOLUTION * * * * * * * * * * * * * * * * * * * * * * 2223
      B(NINDP)=R(NINDP,NVAR)                                              2224
      DO 100 I=2,NINDP                                                    2225
      J=NVAR-I                                                            2226
      IX=I-1                                                              2227
      B(J)=R(J,NVAR)                                                      2228
      DO 90 L=1,IX                                                        2229
      K=J+L                                                               2230
   90 B(J)=B(J)-B(K)*R(J,K)                                               2231
  100 CONTINUE                                                            2232
      DTRMC=0.                                                            2233
      DO 110 J=1,NINDP                                                    2234
  110 DTRMC=DTRMC+B(J)*RX(J,NVAR)                                         2235
      RETURN                                                              2236
      END                                                                 2237
      FUNCTION RNGEN(IX)                                                  2238
C     RANDOM NUMBER SUBROUTINE FOR A BINARY MACHINE                       2239
C     GENERATES UNIFORM RANDOM NUMBERS IN THE INTERVAL 0 TO 1             2240
C     GENERAL USAGE IS AS FOLLOWS                                         2241
C     A=RNGEN(IX)                                                         2242
C     IX SHOULD BE INITIALIZED TO ZERO IN THE PROGRAM                     2243
C     IARG CAN BE ANY LARGE, ODD INTEGER                                  2244
C     CONSTANTS MUST BE COMPUTED BY FOLLOWING EQUATIONS                   2245
C     * * * *  ICON1=(2**((B+1)/2))+3  * * * *                           2246
C     * * * *  ICON2=(2**B)-1          * * * *                           2247
C     * * * *  FCON3=1./(2.**B)        * * * *                           2248
C     WHERE B= NUMBER OF BITS IN THE INTEGER WORD                         2249
C                                                                         2250
      DATA IARG/759821/                                                   2251
      IF(IARG.EQ.IX) GO TO 10                                             2252
```

```
      IX=IARG                                                    2253
      IY=IX                                                      2254
      ICON1=16777219                                             2255
   10 IY=IY*ICON1                                                2256
      ICON2=2147497671[illegible]55                              2257
      IF(IY.LT.0) IY=IY+ICON2+1                                  2258
      RNGEN=IY                                                   2259
      FCON3=.35527136785E-14                                     2260
      RNGEN=RNGEN*FCON3                                          2261
      RETURN                                                     2262
      END                                                        2263
```


EXHIBIT 6

EXHIBIT 7

INPUT DATA

A Three title cards, first must have an A in column 1

B Specification card

1. NDUR - Number of durations, dimensioned for 8.
2. IYRA - Earliest year of record at any station, dimensional for 100 years (NYRS) and NYRS times NDUR (B-1) dimensioned for 400.
3. ISKEW - Indicator, positive value calls for reading skew coefficients for region.
4. KEEP - Number of stations to keep from the immediately preceding job, dimensioned for 10.
5. ICONV - Indicator, positive value calls for reading factors to convert volumes to average flow rates.
6. IPCHQ - Indicator, positive value calls for punching recorded and reconstituted flows on cards.
7. IPCHS - Indicator, positive value calls for punching statistics on cards.
8. NSTAT - Number of stations for which statistics are to be read in, leave blank if statistics are to be computed, no limit on number.
9. NSMTH - Indicator, blank or positive value causes smoothing of statistics.
10. INCAD - Indicator, positive value calls for adjustment of increment to reduce skew coefficient. DO NOT use routinely as frequency curves will be biased.

C Duration description card

1. AAAB - Title of duration such as "PEAK" or "1-DAY," NDUR(B1) items

D Skew coefficients, omit if ISKEW (B3) is not positive

1. SKW - Regional skew coefficient for each successive duration, NDUR(B1) items

E Stations kept, omit if KEEP(B4) is not positive

1. KEPT - Station number (ISTA) of station in preceeding job, KEEP(B4) items. Should be listed in same order as appearing in previous job.

F Conversion factor, omit if ICONV(B5) is not positive

1. P - Factor by which flows for each successive duration are divided to convert to average rate of flow, NDUR(B1) items

G Data cards, omit if NSTAT(B8) is positive

1. ISTA - Station number, limited to five digits
2. IYR - Year number
3. QM - Flow, NDUR(B1) items, -1 indicates missing record. If record for entire year is missing, omit card for that year.

H Card blank after Col 1 to indicate end of flow data, omit if NSTAT(B8) is positive.

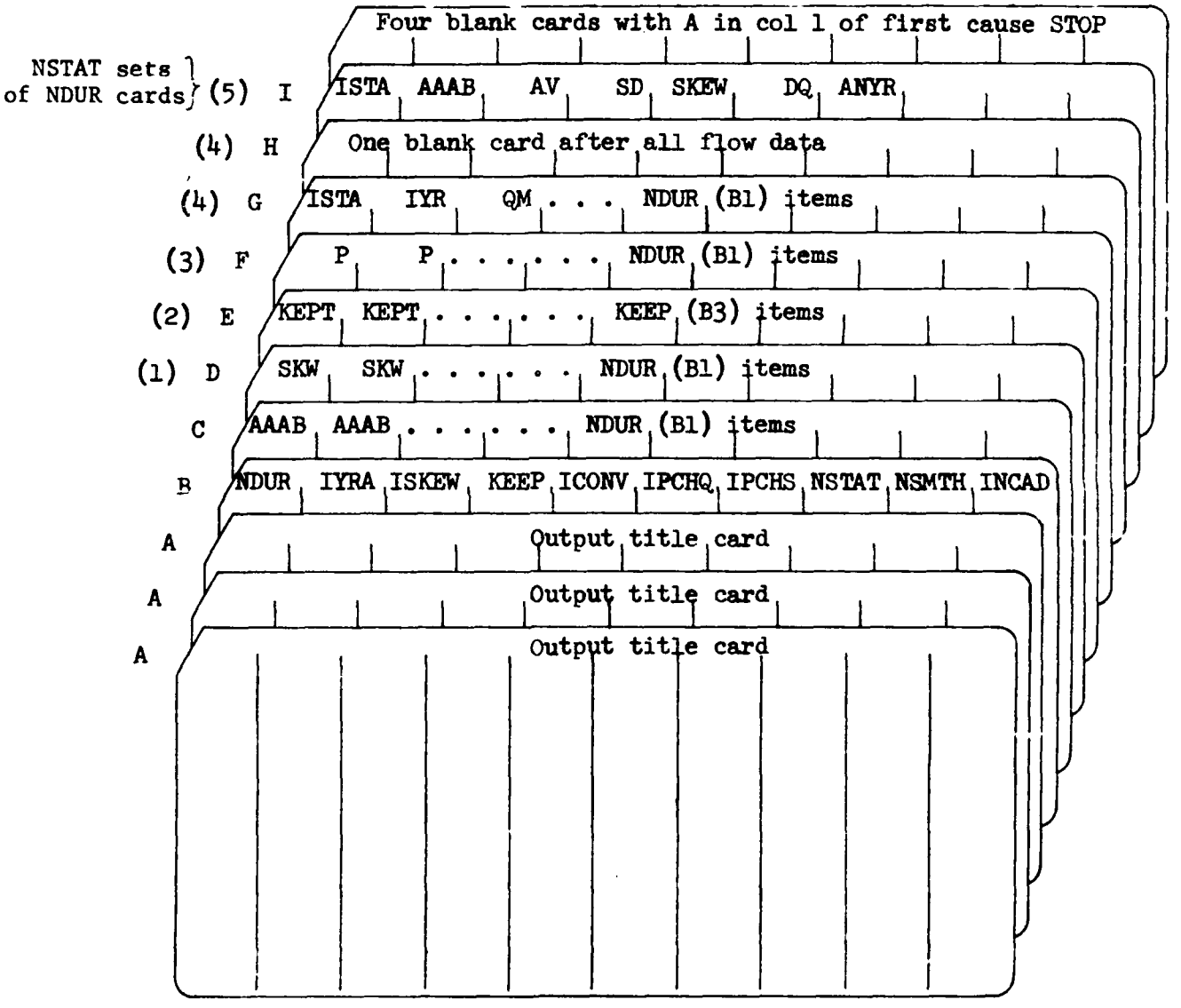
I Input statistics, omit if NSTAT(B8) is not positive. Supply NDUR(B1) cards for each station and data for NSTAT (B8) stations. The order of the durations must be maintained for all stations.

1. ISTA - Station number, limited to five digits.
2. AAAB - Title of duration (see C card.)
3. AV - Mean logarithm for given station and duration
4. SD - Standard deviation of logarithms.
5. SKEW - Skew coefficient of logarithms.
6. DQ - Increment added to flows before statistics were computed.
7. ANYR - Number of years of equivalent record.

Four blank cards with A in Col 1 of the first after the last job will cause a normal stop.

SUMMARY OF REQUIRED CARDS

723-X6-L7350



Notes

(1) Omit if ISKEW (B3) is not positive.
(2) Omit if KEEP (B4) is not positive.
(3) Omit if ICONV (B5) is not positive.
(4) Omit if NSTAT (B8) is positive.
(5) Omit if NSTAT (B8) is not positive.

EXHIBIT 8